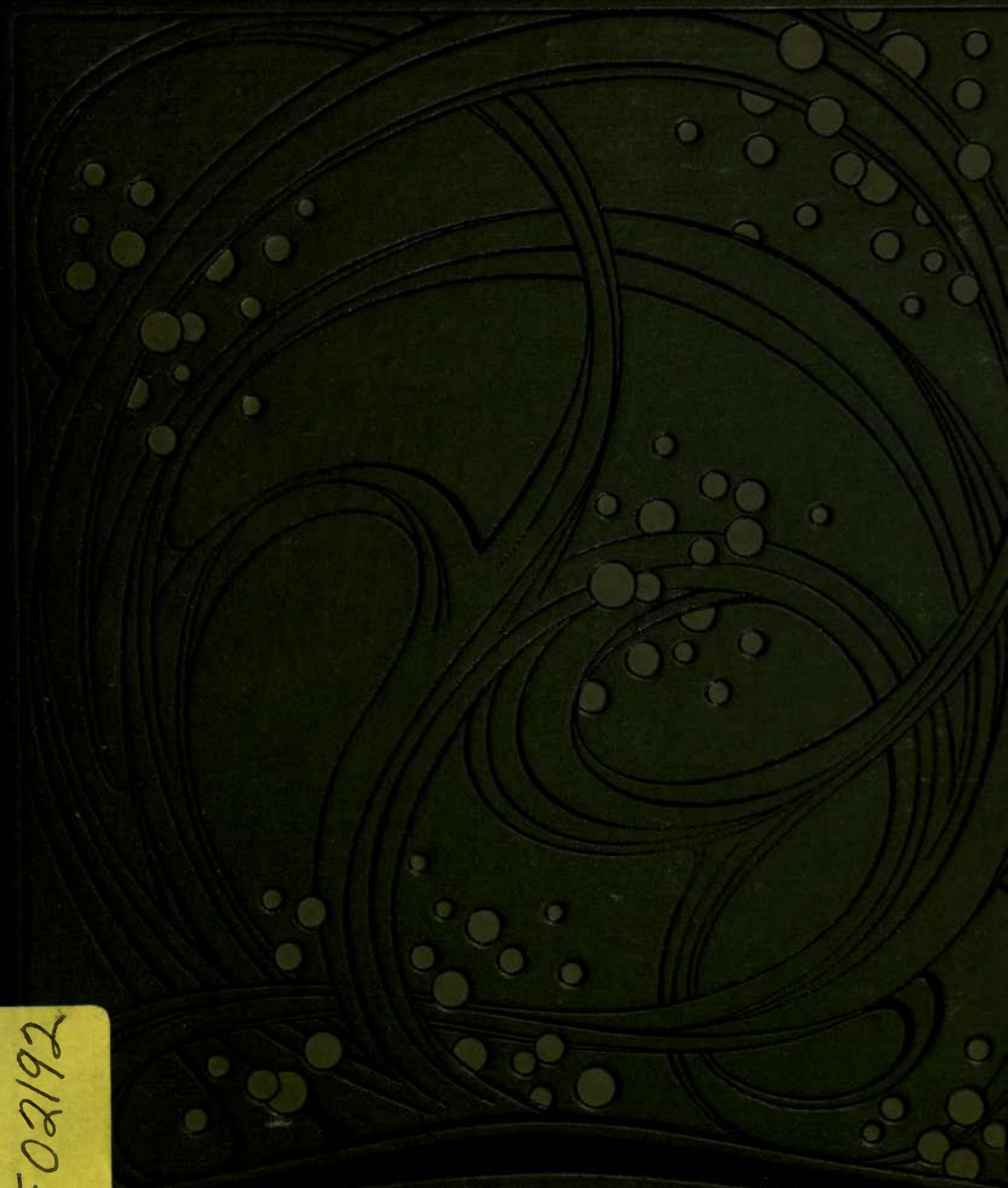
THE HORSE

ITS TREATMENT IN HEALTH & DISEASE



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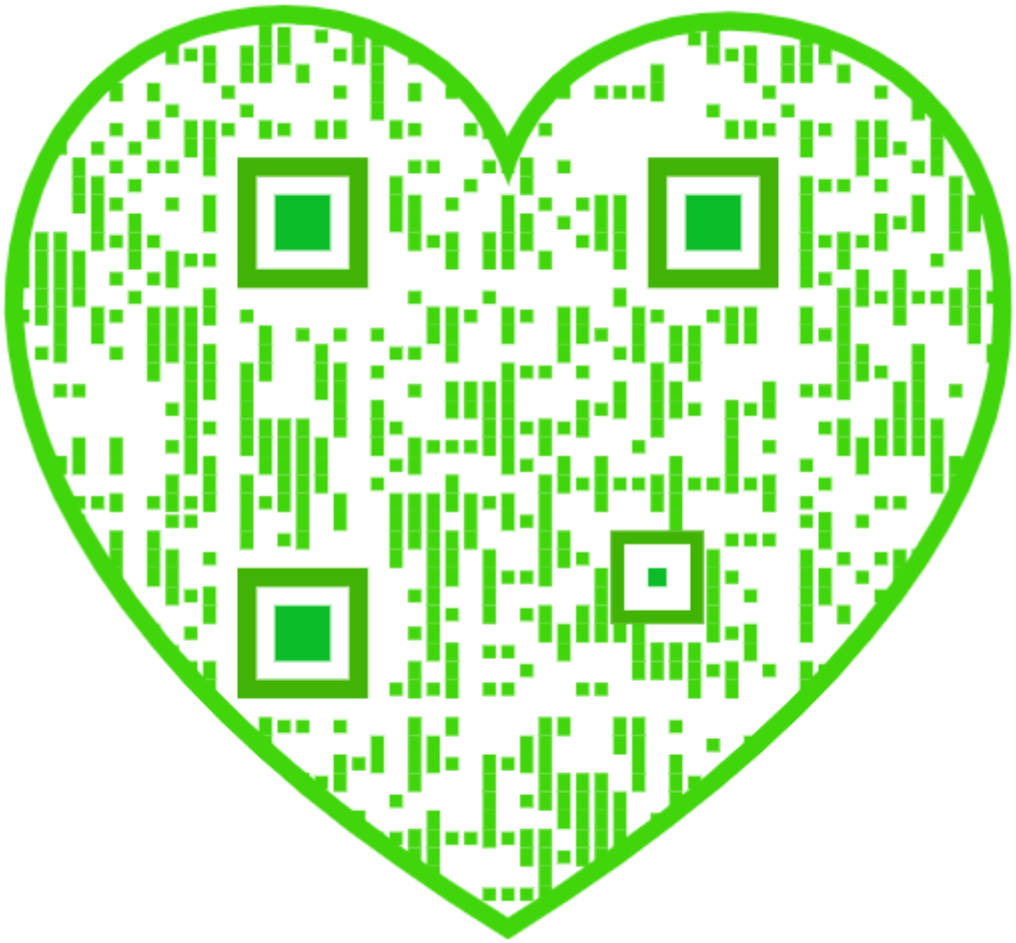

investing membrane of the yolk (yolk-sac), it will be quite easy to understand that at a certain part in the blastodermic membrane a round mass of cells appears, called for the sake of distinction the germinal area. In this round mass, which soon becomes an oval mass, the first sign of the embryo is seen, as shown in the accompanying figure (fig. 538, *e*).

On each side the primitive groove or trace above described, are collected two oval masses of cells rising above the plane of the germinal membrane and bending towards each other until they touch and form an arch in which the incipient spinal cord is to be lodged; all this is arranged, it must be observed, in the upper or serous layer of the germinal membrane. Immediately below the primitive groove a line of cells may be recognized, forming the *chorda dorsalis*, the rudimentary stage of the bodies of the bones of the back (dorsal vertebræ). Then below the primitive groove, at the same

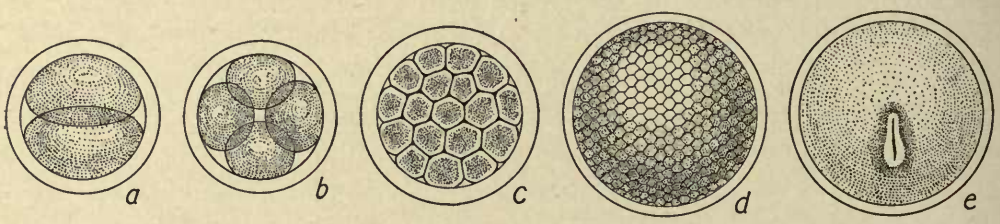

Fig. 538.—The Development of the Ovum

a, First division of the ovum; *b*, *c*, *d*, subdivision of the ovum; *e*, first trace of the embryo.

time that the cells of the laminæ dorsalis are closing over to form the central canal for the spinal cord, the serous membrane sends off prolongations from its lower margin, the *laminæ ventrales*, which unite to form the walls of the trunk to enclose the abdominal viscera.

As they proceed downwards, the *ventral laminæ* turn inwards, enclosing part of the yolk-sac, after which the yolk and inner mucous layer of the germinal membrane are divided into two portions, one being retained in the body of the embryo, the other being left outside. The latter is called the umbilical vesicle. The mucous layer of the germinal membrane now lines the interior of the abdominal cavity and also the interior of the umbilical vesicle. The upper or serous layer is continued round both, and from the portion of the mucous layer enclosed in the body of the embryo the intestinal canal is developed.

This state of the embryo is represented in the next illustration (fig. 539).

Fœtal Membranes.—While the changes above described have been going on, the formation of the fœtal membranes, the allantois and amnion, is proceeding. Folds of the external layer of the blastodermic membrane are raised to enclose the body of the embryo forming the amnion; at the same time during the development of the amnion the allantois protrudes from

the hinder portion of the intestinal canal, as a small pear-shaped mass of cells at first, but, rapidly extending, it presses its way between the folds of the amnion and comes in close contact with the outer one of the two folds, becoming more vascular as it proceeds. Reaching the umbilicus, the allantois is divided into two parts. The outer part, however, extending to the external investure of the ovum, the chorion, shrivels, and is lost; the other portion remains in the abdominal cavity, and part of it is converted into the urinary bladder, while the remaining portion extends from the bladder to the umbilicus under the name of *urachus*, which after birth forms one of the ligaments of the bladder.

It may be remarked here that an oval body flattened in form, which is commonly described as a false tongue, and sometimes affirmed to exist in the mouth of the foal, is really a concretion which is met with in the fluid of the allantoid sac, and nowhere else; occasionally there are several of these bodies, of various sizes. The name given to them, "*Hippomanes*", indicates that they were known to the Greeks, and an ancient superstition attributed to them talismanic power, a belief in which still exists in some parts of the country.

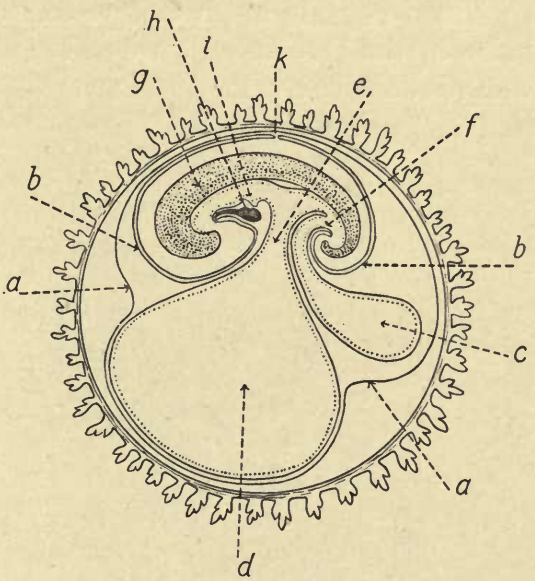

Fig. 539.—Development of the Embryo, eighteenth day

a, Outer or corneous layer; *b*, amnion; *c*, allantois connected with the anal portion of the alimentary canal; *d*, yolk-sac or umbilical vesicle; *e*, vitello-intestinal opening; *f*, simple alimentary canal in lower position; *g*, trunk and head of embryo; *h*, fœtal heart; *i*, alimentary canal in upper portion; *k*, place of convergence of amnion and reflexion of false amnion or corneous layer.

The annexed figure (fig. 539) shows the arrangement of the three membranes which invest the ovum, *i.e.* the external chorion, the amnion, the outer portion of which becomes in part firmly attached to the inside of the chorion, and the allantoid sac.

The villi on the outer surface of the chorion of the human ovum (fig. 540) are seen to be massed on the right side of the figure to form the placenta. In the equine ovum there is no circumscribed placenta, but instead the vascular villi are connected throughout with the internal uterine membrane by means of numerous placental tufts, which penetrate the lining of the uterus so that the capillaries of the fœtal vessels and those of the maternal vessels are in contact over the whole surface. There is, however,

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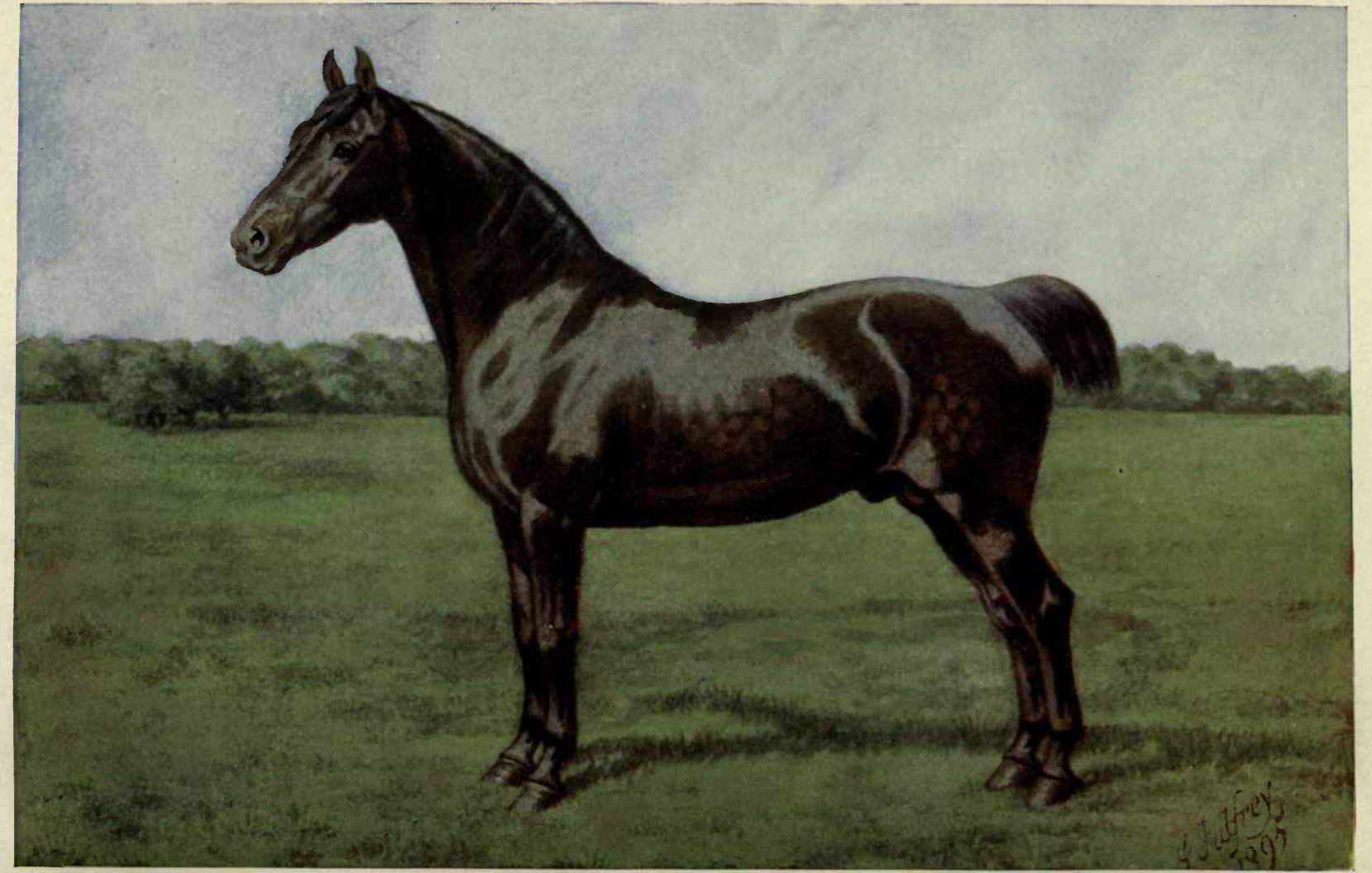
THE HORSE

ITS TREATMENT IN HEALTH AND DISEASE



PONY STALLION, SIR GEORGE

THE HORSE

ITS TREATMENT IN HEALTH AND DISEASE

WITH A COMPLETE GUIDE TO BREEDING, TRAINING AND MANAGEMENT

Edited by

PROF. J. WORTLEY AXE, M.R.C.V.S.

DIVISIONAL VOLUME VIII

LONDON
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34 SOUTHAMPTON STREET, STRAND

THE HORSE

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Late Lecturer at the Royal Veterinary College, and at the Agricultural Colleges of Downton and Wye
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"Examination of Horses as to Soundness" "Glanders, its Spread and Suppression" "Swine Fever"
"Lithotomy or the Removal of Stone from the Bladder of the Horse"

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EQUINE LOCOMOTION

SECTION V.—EQUINE LOCOMOTION

The paces of the horse cannot well be understood without reference to the means by which locomotion is brought about.

In the anatomical portion of this work frequent reference will be found to the origin and insertion of muscles, and the attachments of tendons and ligaments. Attention is called to the fixed points upon which muscles act by the shortening of their body or "belly". The stimulus of the will or other agents put in action a force which causes a contraction of muscular fibre, resulting in approximation of the fixed points of origin and insertion.

A familiar example of this action is seen when the human biceps, by its bellying or contraction, changes the contour of the limb and brings the hand to the point of the shoulder.

The horse may be viewed as a living mechanism, a series of pulleys and levers attached to bones, and having the ground for a fulcrum.

The comparison is not, however, so complete as some Continental writers have striven to prove. Marey says: "The comparison between ordinary machines and animated motive powers will not have been made in vain if it has shown that strict relations exist between the form of the organs and the character of their functions; that this correspondence is regulated by the ordinary laws of mechanics; so that when we see the muscular and bony structure of an animal we may deduce from their form all the characters and functions they possess".

THE HORSE STANDING

Given a sound, well-proportioned horse standing to "attention", or "collectedly" as masters of equitation are wont to term it, with head up and ears forward, the face will have a profile whose angle to the ground is about 45 degrees, and the weight will be equally distributed among the four supports (limbs). As a matter of observation, horses seldom adopt this exact position, rather choosing to advance one foot slightly in front of its fellow, despite the training which they may have undergone in "dressing" in a troop of horses.

Movement must have some point of departure, and we will assume that our subject is in the position which Barrier and Goubaux, Le Coq and Stillman, Hayes and Marey all assume as possible, though Captain Hayes alone, among the authorities named, while admitting the *possibility* of an attitude such as is assigned to the horse by Goubaux, adds, "I have never seen a horse adopt it". Without insisting upon minutiæ we may suppose our horse to be standing as nearly "square" as a horse will. In any change of attitude the centre of gravity will be shifted, and recovered by obtaining a new base of support.

In the slow pace of walking there is no elevation of the centre of gravity, and consequently no danger of losing the equilibrium; but in the faster paces this danger exists, as will be readily seen in the illustration of a horse extended at the gallop, with the head advanced to the utmost limit which other conditions of its carriage will permit (fig. 529). The draught-horse (*pushing*, be it remembered, for it is not *draught*[1]) lowers his head (when not artificially restrained by the bearing-rein), and so brings forward the centre of gravity. With the advance of a limb a new base of support is obtained, and as long as the centre of gravity falls within the base of support, equilibrium is maintained. In raising a limb the resistance encountered is only that of its own weight, or pressure of the atmosphere, and propulsion of the animal above and in front of the perpendicular line of the centre of gravity is brought about by straightening the limb against the immovable surface of the ground.

Fig. 529.—Equilibrium in the Gallop

Diminished resistance, as in deep ground, results in a lesser degree of propulsion, apart from the deterrents to progression which arise from suction and the additional weight of soil attached to the foot. A good example of propulsion by straightening of the limbs against a fixed object is that of the swimmer who touches, turns, and strikes off from the side of the bath; the wall being immovable (with the force at disposal), while the water is readily displaced.

[1] The propulsion of a vehicle is brought about by a series of levers bent upon one another between a fixed and a movable point. These levers act against the ground, where the toe is placed, and the collar.

Through the columns of bones the propulsion is directed, and of these in the horse two sets are in operation. The limb producing a forward and upward movement being invariably directed backward and downward, must necessarily act in the direction stated.

The impetus obtained from the horse's fore-leg is through the humerus and elbow-joint, while that of the hind-limb is through the medium of the hip-joint and pelvis.

SPEED

Speed is not due to the strength of the muscles, or we should find strong cart-horses with light bodies competing with the blood-horse. It is due to the rapidity with which the limbs can be straightened out in contact with an immovable body.

With few exceptions, it may be said that animals of great speed have long limbs and slender muscles, while those possessed of great strength have short limbs and thick muscles. A comparison between the race-horse and dray-horse, or between the greyhound and bull-dog, will serve to illustrate our meaning.

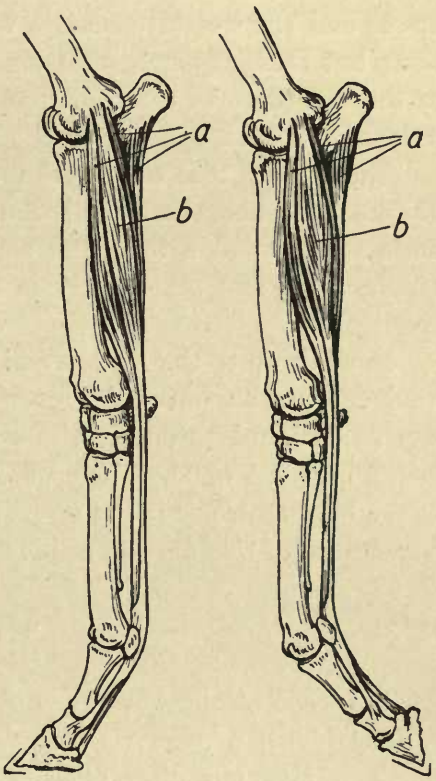

Fig. 530.—Action of the Flexor Muscles and Tendons of the Fore-Limb

a, Flexor pedis perforans. *b*, Flexor pedis perforatus.

Upon the distance through which the centre of gravity is moved, in the various paces, depends the degree of fatigue produced. Where there is a period of suspension—all the legs being clear of the ground (Plate XII)—the centre of gravity is necessarily raised, and thus it follows that the fast trot, canter, or gallop over a given distance takes more out of a horse than the walk or slow trot, where there is no such period of suspension.

The raising of the centre of gravity in each of the paces where there is a period of suspension is exactly equal to its fall (or vice versa).

The changing of the centre of gravity from one side to the other is facilitated by the head and neck acting as a balance. The muscles connecting the head and neck with the trunk assist in raising the fore part of the body during locomotion.

THE TROT

There are three forms of trotting recognized by horsemen, and described as the slow or short, the common or ordinary, and the fast or flying trot. In the first the prints of the hind-feet respectively are found in rear of those made by the corresponding front ones; in the second they cover or slightly overlap; and in the third there is a period of suspension intervening between the right and left diagonal movement. The movements concerned in this pace may be described as alighting, support, leaving, suspension, and coming down on opposite diagonals.

The same amount of work being required of both front and hind limbs in the trot, a horse can maintain a comparatively fast rate of speed for a longer time at this pace than at any other. The diagonal supports of the trot facilitate the maintenance of equilibrium, and for this reason give the trot an advantage over the amble and canter, in both of which it is more considerably displaced (Plate LVIII).

THE AMBLE

In this pace, which may be described as one of two time, there is scarcely any suspension, unless it is pushed to that form known in America as "pacing", when (from examination of the best photographs hitherto produced) there appears to be an undoubted period of suspension. Progression in this gait is brought about by the alternate movement of the left and right pair of legs, or, of course, of the right and left.

THE CANTER

The canter is an intermediate pace between the amble and the gallop. It is a movement of three time, the entire weight resting momentarily on one or other hind-leg.

The order in which the feet come to the ground, supposing the right hind is supporting the animal alone, will be as follows:—1, right hind; 2, right fore and left hind; 3, left fore, with or without a brief period of suspension before the right hind is brought down.

Photographs of heavy horses (80th of a second exposure) leave us under the impression that there is no period of suspension whatever; but a well-bred lady's hack, schooled to the pace, proves that there is such a period in the more elastic members of the equine family.

The canter is an easy pace to the rider, but, save as a relief to some

other, cannot be recommended for the horse. He seeks to relieve the fatigued muscles by changing sides, and is usually trained to do this by a light stroke down the shoulder with the whip.

The fore-leg which is not acting as a diagonal support is called the leading leg, and a horse is said to be cantering to the left or right according to which leg is leading.

As a straightforward pace, cantering is perhaps the safest of all, but while cantering a horse should not be asked to turn, except towards the

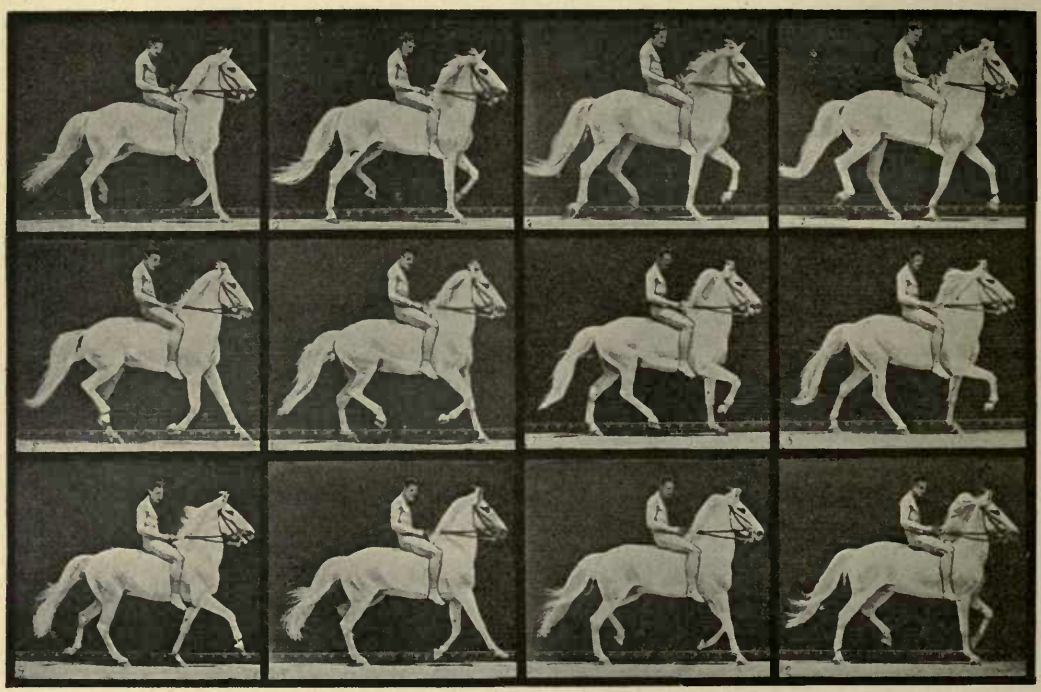

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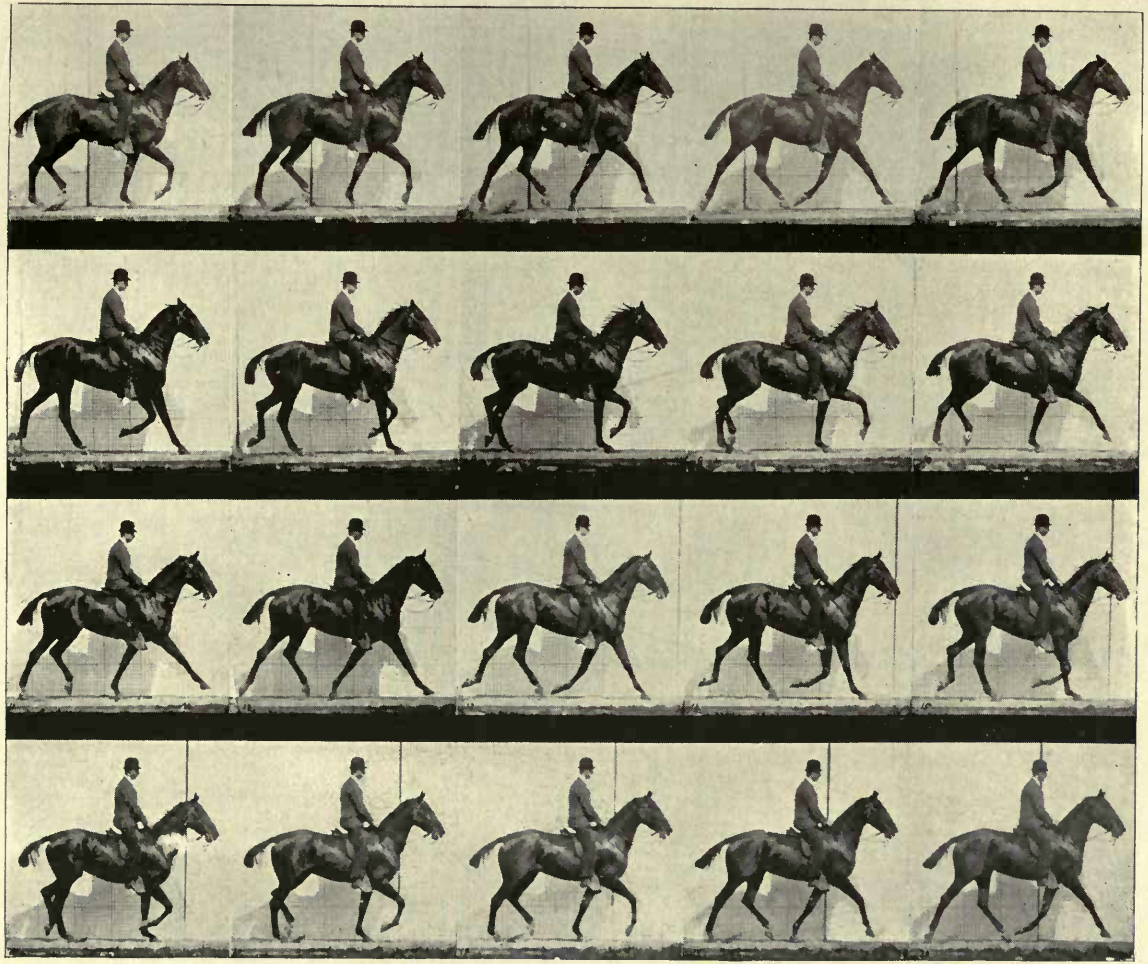
Fig. 531.—The Canter

side of the leading leg; neglect of this precaution renders him liable to cross his legs and come down.

The hind-leg upon which the whole of the animal's weight is momentarily imposed, is on the opposite side of the leading fore-leg.

There is a fast canter, more frequently called a "hand-gallop", in which the diagonal support does not act unaided. The period of suspension in the canter is obtained in the same way as in the gallop, the straightening of the leading fore-leg raising the forehand.

Listening to the uninterrupted sound of a horse cantering to the left, it will be noted that the interval of suspension between the coming down of the left fore and right hind feet is of greater duration than either of the



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THE TROT

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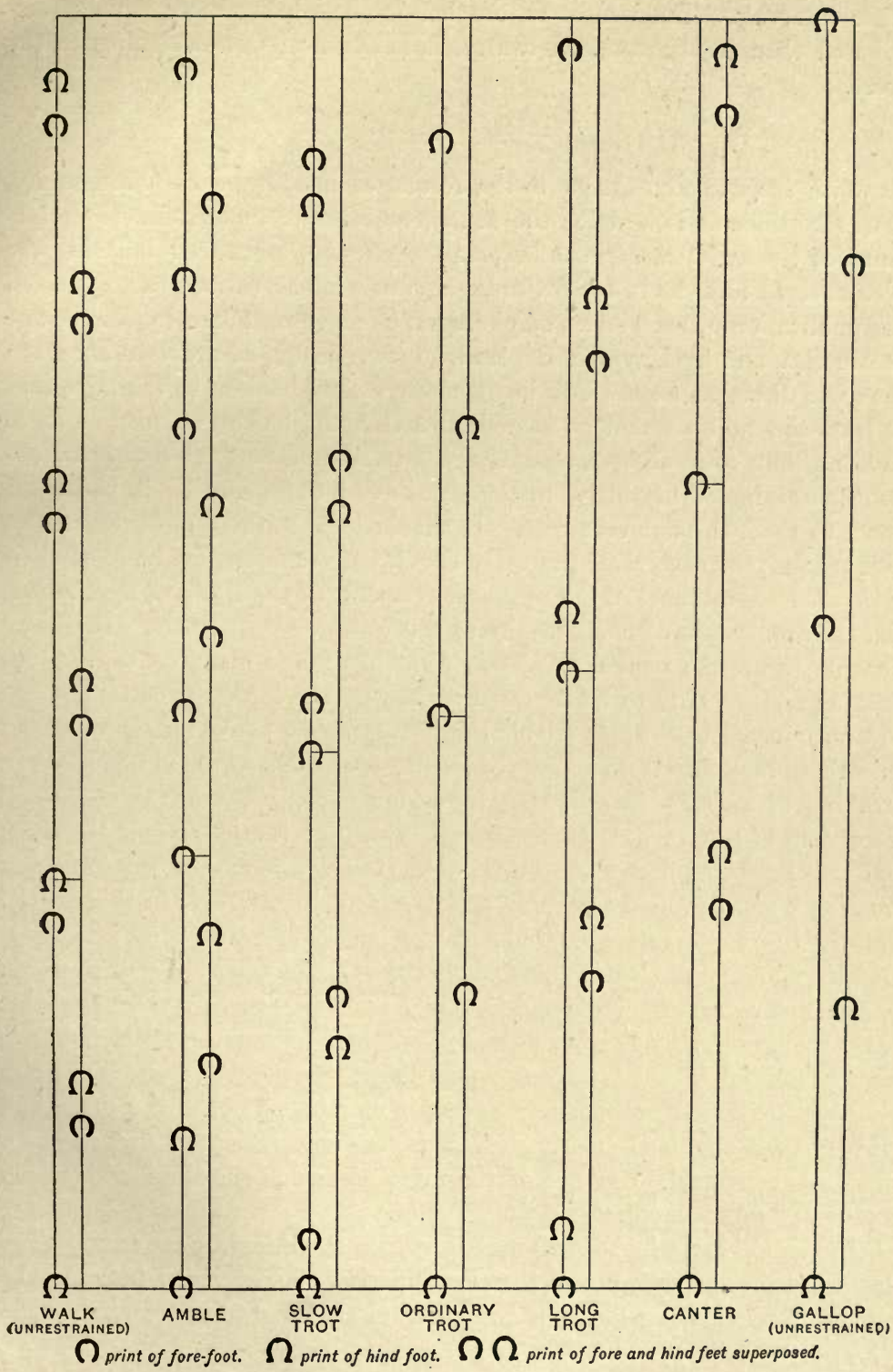


Fig. 532.—Trails (Footprints) of the Various Paces

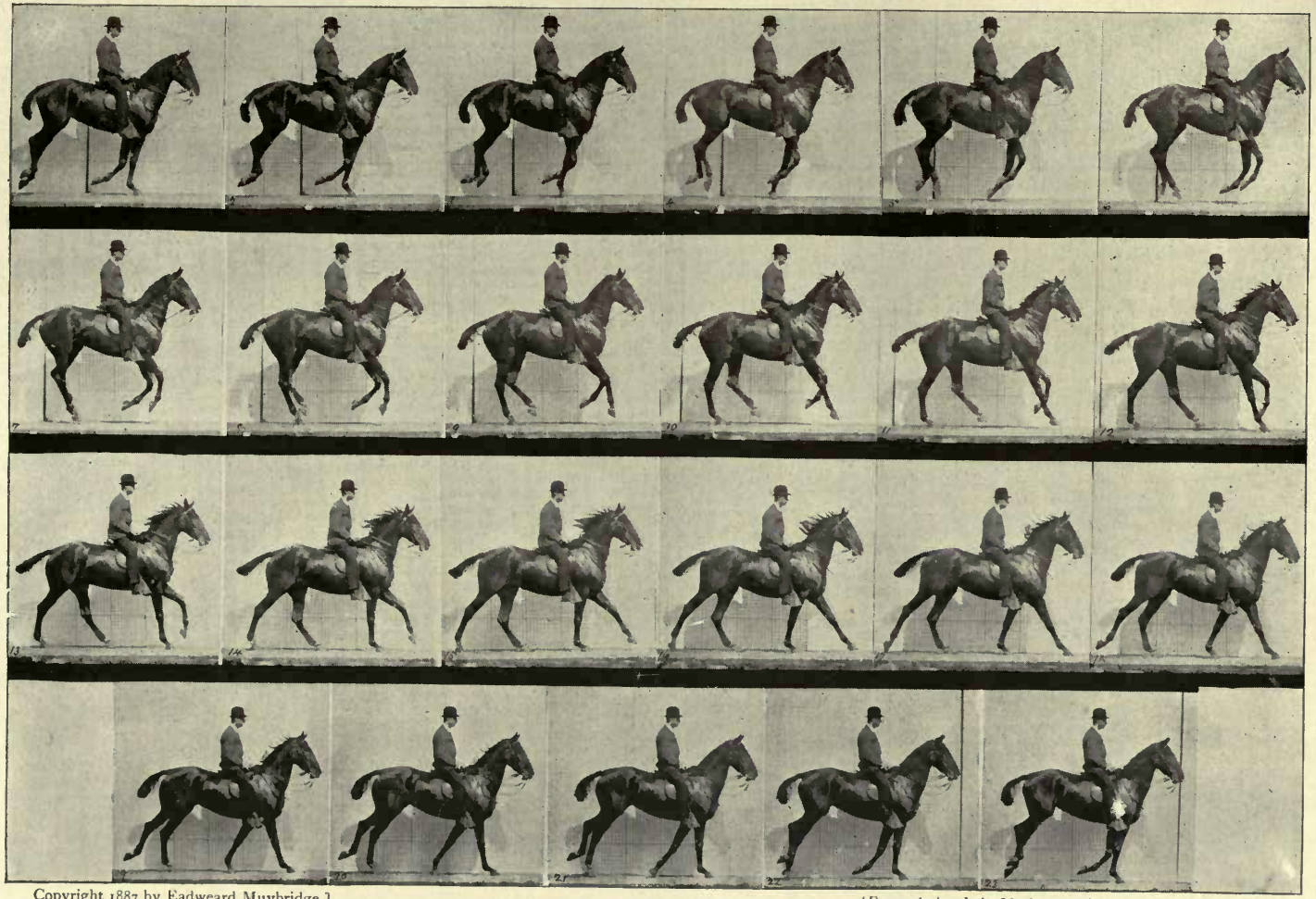
other intervals. The weight in the hand-gallop being more equally distributed than in the common canter, it is distinctly less fatiguing to the horse.

THE GALLOP

With the eye accustomed to the results of instantaneous photography, it will be difficult indeed for the next generation to understand the reluctance of the artist and the horseman to give up, as proved fallacies, the preconceived ideas as to the attitudes assumed in the various paces. Until the publication of such series of photographs as those taken by Muybridge in America, and by Hayes in England, to say nothing of previous efforts in the same direction on the Continent, many artists held on to the hope that at least the gallop would be spared, and that the horse extended so as to have no limb to straighten against the ground, and supported only by the atmosphere under his belly, might be allowed to remain as it had come down to them through centuries. It should be remarked, however, in this connection, that several of the early Greek writers afford evidence of their more accurate estimate of the precise movements of the horse in locomotion, and the application of photography to this question goes to show that they were on the road to the discovery of what has for so many centuries since been a mystery, only to be revealed at last by the highly-sensitized plates and improved lenses which enable the photographer to fix for us images of animals in motion. With a range of twenty-four cameras, acted upon by the breaking of a cotton thread, Mr. Muybridge was enabled to take pictures[1] (reproduced in Plate XII) of horses galloping past at all stages of the pace; and this has since been done by Captain Hayes, whose work on *Points of the Horse* will be found to supply details which space forbids in this article. But for the conservative attitude of the public in matters of art, Muybridge's photographs would have spoilt the value of what are still regarded as priceless works of the old masters, and as it was, there was considerable anxiety expressed by holders of many paintings of repute in which horses are represented in what we now know to be impossible attitudes. From the point of view of present-day artists, it may be said that the grace and symmetry of the leap-creations of a former generation of draughtsmen must be abandoned in favour of the more accurate definitions with which photography has supplied us.

The gallop is a "four-time" pace, in which the intervals are equal. The feet follow in succession, and there is a period of suspension between the putting of the leading fore-foot and opposite hind one to the ground. The

[1] In his preface to *The Horse in Motion*, Mr. Leland Stanford says, "The time occupied in taking each of these views is calculated to be not more than the five-thousandth part of a second".



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THE CANTER

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PLATE LIX

fore-leg of the diagonal support comes to the ground after its hind fellow, while in the canter it was shown that the reverse was the case, the fore-leg coming to the ground either immediately prior to, or at the same time as, its hind fellow. The canter and gallop are much alike, and the former readily becomes a gallop by the greater extension of the leg that is not leading.

The leading fore-leg in the gallop is more extended when it touches the ground than its fellow, and has also to afford a longer period of support than either of the other three legs. It follows, therefore, that the leading fore-leg is more subject to sprain of the back tendons and suspensory ligament than the non-leading leg. As the left fore-leg is the one usually chosen to lead because more convenient to the rider, it is found to be more frequently injured than the right. Captain Hayes thinks the ligaments of the leading fore-leg are sprained by over-extension and not by concussion, which latter is greater upon the non-leading leg "by reason of its coming on the ground at a moment when it is wholly unsupported by the other fore-limb".

In the gallop, the horse seldom has more than two feet on the ground at the same time, and if a third touches it it is for the briefest possible period. The extreme extension of the fore-feet represented in many old prints is shown to be possible by some of Muybridge's photographs (see Plate XII), and in such positions of the body and forehand the face will have its profile vary between 40 and 55 degrees or even more.

If the reader will follow the figures he will get a more correct knowledge of the successive movements of the limbs in this most interesting, because fastest, pace of the horse, than from any verbal description we can give.

LEAPING AND JUMPING

In jumping, the forehand is first raised, and the body and hind-quarters made to follow by the straightening of the hind-limbs against the ground. The period of suspension in the leap is when the hind-feet have left the ground.

It is customary to speak of several kinds of jumping or leaping, although produced by the same main springs. There is the standing and the running jump, the high and the long leap.

Taking-off.—A horse takes-off or commences his jump in a variety of ways, according to whether he is standing (the standing leap), ambling, cantering, or galloping. Few horses can jump properly from the trot, although it is of great advantage to be able to do so.

In the canter or gallop the animal prepares to take-off by straightening

his fore-leg on the fetlock and raising his forehand; the corresponding hind-leg (usually, but not always) is next brought down, and then the other (whichever it may be), when, as stated above, he clears the obstacle by straightening the hind-limbs and projecting himself upwards and forwards. There appears to be no suspension between the straightened leading fore-leg supporting the animal and the bringing down of the first hind-foot.

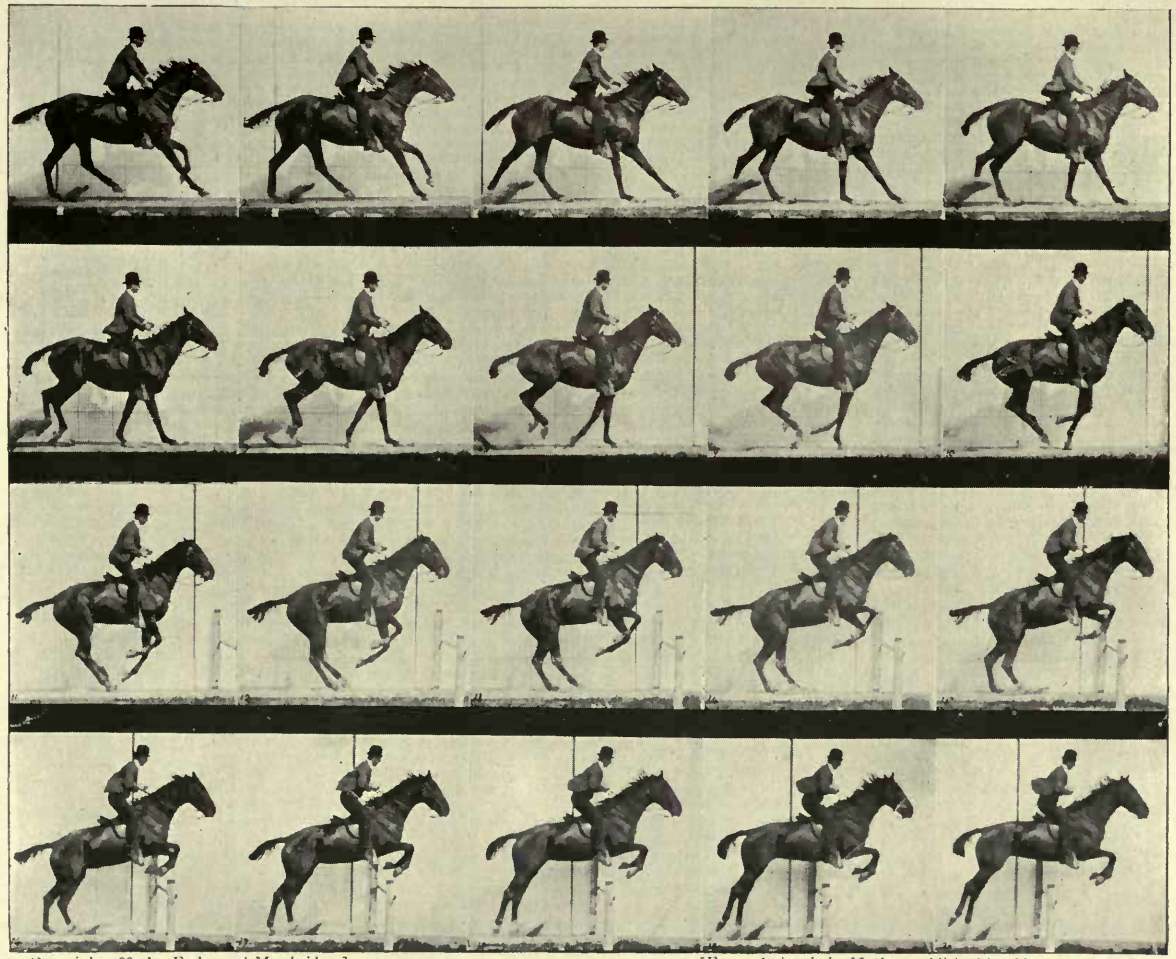
In the standing leap the animal can only accomplish his purpose by rearing, and he takes advantage of the ground to the utmost by breasting the object or pushing right up to it before rising at it. Horses that can leap from the standing position are often the most troublesome to keep in bounds, while really good flying leapers can be kept at home by a low fence round a cramped paddock.

"Clever" jumpers, so-called, are those best able to judge of the time and distance in which they will have to take-off, and who prepare themselves so as to have the leading leg ready to plant at a spot near enough to and yet not too near the obstacle to be negotiated, since it will increase the length of the jump if the horse takes-off too soon, while the height may not be surmountable if too close, and the animal has to raise himself too near to a perpendicular line.

Horses with a long stride are more liable to the mistake of taking-off too "big" or jumping too soon than are short quick steppers, or those which, measuring the distance with unerring eye, put in one short step to correct the number of strides, which would else be too many or too few to bring the jump to the right spot.

The flying jumper is easier to sit, and though he seems rash he seldom comes to grief; but he cannot get one out of a narrow lane like a horse that "creeps" up to his jump and projects himself over without any residual impetus when he lands. It may be taken as a broad rule that all horses jump better from the canter or gallop, and that those able to jump nicely from the trot are scarce and esteemed, because able to perform under cramped conditions, where the flying leaper would be "pounded". The horse that can jump from the trot has the additional advantage of being able to choose from two different periods when he will take-off, these being when either of the respective diagonals comes to the ground.

The length of a horse being somewhere about 8 feet (the cavalry drill makes an allowance of $8\frac{1}{2}$ feet), there is considerable length to be carried, as well as height to be surmounted, in getting over an obstacle by jumping. With these points in view, the reader will see that it is necessary for a horse to get a good spring or impetus by getting up a bit of speed some little distance from the object to be negotiated. The greater the speed at which



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[From *Animals in Motion*, published by Chapman & Hall.

THE LEAP: APPROACHING AND TAKING OFF

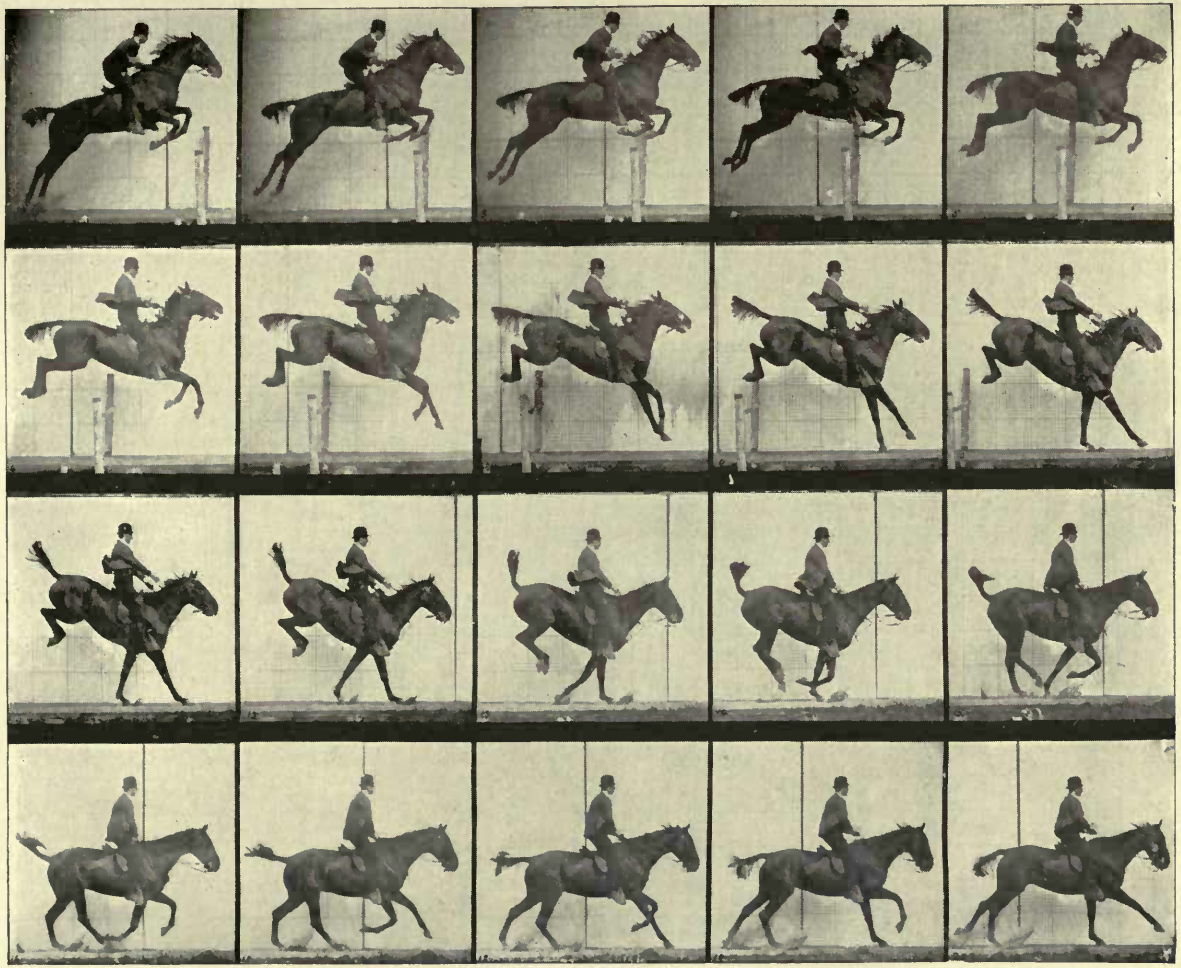
PLATE LX

he takes a long jump, the farther is his body projected, there being two agencies at work in propelling him, namely, the power of the muscles, to which is added the impetus gathered by the speed in approaching the jump. It is not found in practice that great speed or impetus in a forward direction (chiefly) is helpful in surmounting high jumps, and the reason is that greater weight is thrown on the forehand, and this will impose more difficulty on the leading fore-leg, whose office it is to raise the forehand off the ground. A certain angle of elevation, of course, is necessary to carry a long body over a level jump, but the angle being low, nearly all the impetus of a fast horse is expended in the right direction. Practical steeplechase-riders are wont to say that a slower pace brings out the longest jump—a pace something short of the topmost, but still having plenty of "weigh" at the point of taking-off. In jumping fences at slow paces (and these are recommended by the cognoscenti), the clever jumper before referred to gets his hind-feet as much under him as possible, so as to expend nearly all the energy gained by straightening the hind-legs in projecting his body upward. He increases the angle of elevation by raising his head. His front legs will be doubled up and his hind straightened to their utmost at the moment of taking a high jump. As to the attitude the rider should assume, there is some difference both of opinion and practice among experts, and we need not here enter into the subject beyond referring the reader to the poses of riders in the illustrations. These have been evolved out of the necessity of keeping in the saddle, and though we can conceive of certain attitudes on the part of the rider which might ease his "mount", those of our horseman on Plates LX and LXI do for the most part conform to the general laws of mechanics.

Landing over a Jump.—While suspended, the good jumper will tuck his feet up as closely as possible. No sooner do his hind-legs leave the ground than he thus prepares himself for anything that may happen; he may not be able to see the landing-place, and he is ready for a deep ditch or other contingency. The careless or untrained animal, on the other hand, drags his hind-legs behind him, and is liable to land upon the top rail of a fence, and cannot avail himself of an intermediate cat-like spring from it, or from the summit of a wall or other obstacle, which trick is a most valuable acquisition among the best of Irish horses and others accustomed to jump stone walls. Some of the best jumpers keep their limbs quite still while in mid-air, but there is no absolute rule, each horse caring for his own safety in the way which commends itself to his individual judgment. If we watch the trained performer at a distance, he appears to come down with both fore-feet at once, but closer observation enables us to see that one foot is invariably in advance of the other, and receives practically all the weight, the

other being slightly bent at the knee, and in readiness, in case of a false step, to save the horse from a fall. The leading leg is quite straight at the moment of landing, and a bent knee would seem to add greatly to the danger of a fall. (It is to be noted, however, that some of the safest conveyances the writer has had were a good deal "over" at the knee.) The right hind-foot follows the right fore, and the same thing applies to the limb of the other side. The print of the hind-foot is found to be in advance of the front one, so that the latter must be picked up and out of the way before the descent of the hind. In sticky ground, and for other reasons, such as a heavy rider rolling about in the saddle and supporting himself on the animal's neck, the fore-foot is not extricated in time, and a serious overreach may result. The forehand is raised after a jump by the straightening out of the limb, and anything that hinders the muscles engaged endangers both the horse and his rider. Severe bits have the effect upon tender-mouthed horses of making them try to land on their hind-feet, and in other ways risk losing their equilibrium. There are still persons to be found who believe that this is the habitual method (landing on the hind-feet), but, as pointed out by Hayes, "the hind-limbs of the horse are altogether unfitted to stand the violent shock which would be transmitted through them if they had to bear the weight of the body on landing. Such poor weight-carriers are they, that a horse disposed to rear has difficulty in walking a few yards on his hind-legs." Circus horses compelled to walk on their hind-legs have commonly large curbs, spavins, and thorough-pins.

The principal paces have now been alluded to; for further details and description of the artificial paces of the riding-schools, readers are referred to the works of Stanford, Hayes, Marey, Goubaux and Barrier, Le Coq, &c.



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THE LEAP: SUSPENSION, LANDING, AND RECOVERY

PLATE LXI

BREEDING

SECTION VI.—BREEDING

THE STUD

There is nothing more satisfying to a breeder of horses than to breed a good one. To win a race over a course, or a prize in a show-ring, affords a certain amount of pleasure, and maybe some profit. While allowing that to bring a horse into a condition to accomplish either of these feats entails a certain amount of intelligence and skill, it falls far short of yielding that substantial and abiding gratification which is afforded by having overcome the far more difficult task of producing the animal by which the one or the other is accomplished.

To breed a winner of a classic race or a champion of the first class is unquestionably the end to be aimed at. That success in these respects seldom comes, even to the most patient and painstaking, should be rather an encouragement than a deterrent, for the more difficult the task the greater the honour.

We could point to many men who, with control of large studs, have spent a lifetime in honest endeavour to realize these higher ambitions without attaining success; but they have done the next best thing, they have produced stock of a high standard of excellence which has brought a remunerative average; and, after all, that is what the general breeder desires and what the country requires — a grading up as near to the highest attainable point as can be reached.

In breeding operations a certain percentage of the produce of the stud are sure to fall below mediocrity in conformation and character, and others, for various reasons, will fail to prove remunerative. To guard against these adverse influences is the great problem which the breeder should strive to solve, and upon which his highest success will depend.

A plentiful supply of common horse stock is assured to this country by our colonies and the Continent; and if it is to hold its position as a centre to which all nations will continue to look for the best and most impressive specimens of the several varieties, those principles of breeding which experience has dictated must be more rigidly followed.

At the present time a large proportion of our Society carriages are horsed with foreign-bred animals, and whatever adverse criticism they have deserved in the past, the unprejudiced judge will not now fail to recognize the high excellence to which they have in recent years attained.

In days gone by, the "foreigner" could be identified by his ill-make and shape at a street's length. He was a leggy, cow-hocked, "narrow-gutted", light-chested, heavy-crested brute, with a back that made the most daring fear to put anything on to it; besides which, his pluck and endurance were proverbially of the worst. All that is altered now. The importation of our best mares and most promising sires into the horse-breeding provinces of France, Germany, Austria, Hungary, and other parts of the western continent, which has been going on for over half a century, has now so anglicized the breed in those places as to enable us not only to procure English horses from abroad, but animals of such a uniform and useful type as to compare favourably with the best of our own.

Bred with the strictest regard to the requirements of our market, in colour, size, action, quality, and soundness, they are now able to compete on equal terms with our home-bred stock, and to fill a void which could not have occurred but for the unreasonable encouragement which has been given to the production of small unmarketable animals by the management of our horse shows and agricultural societies.

GENERAL REQUIREMENTS OF THE BREEDING-STUD

Conditions conducive to health are of the first importance to success in the breeding and rearing of horses, and however well designed the plans may be in other respects, neglect of this cardinal point is sure to end in failure.

The man who is willing to invest his money in the purchase of good stock at the outset, should be sure that nothing stands in the way of maintaining and enhancing its high standard of excellence. For the lack of this precaution the writer has witnessed many painful examples of failure and disappointment.

Site.—A good site and aspect, ample and well-designed stabling in the midst of, or in close proximity to, a suitable, well-conditioned farm, constitutes the bed-rock on which the foundation should be laid. A high and dry position, sheltered from the east and north by rising ground, is the most desirable site, and where choice is permissible should be selected.

It is not, however, to be understood that a less elevated position is necessarily objectionable. This would depend a good deal on the nature and porosity of the soil, the extent and efficiency of drainage, and whether the

country was heavily wooded or open. The fen lands of Lincolnshire and Cambridgeshire, although low-lying, are nevertheless well adapted to horse-breeding. Their light, fertile soil, luxuriant herbage, and free open country, where neither fences nor trees interfere with the free circulation of air and escape of moisture, all conduce to a state of atmospheric dryness and salubrity, notwithstanding the numerous water-courses which intersect the land.

Soil suitable for breeding and rearing horses, although variable in its nature, is influenced in a great measure by the extent to which it is drained and wooded. In a well-drained, open country, where the moisture is carried off and not allowed to stagnate and become dissipated merely by evaporation, a fairly strong clay may prove useful; while the converse of these conditions will render the air so humid and damp, and the soil so cold, that both plant and animal life will be prejudicially affected. Trees and fences, by breaking the force of the wind and affording shelter from storms, are most desirable adjuncts in due proportion and when suitably disposed, but when existing in excess they not only impart dampness to the district by preventing the free circulation of air, but in summer-time they form a breeding-ground for flies, which worry and torment horses so, that grazing is interfered with and constant stamping provoked, causing serious damage to legs, and especially to those of growing animals.

To go into the subject of geological formation best suited to the breeding of horses would open up a very difficult and debatable question.

To what extent it influences the success or failure of breeding operations it is impossible to say, but it is important to notice that by far the greater number, and the most valuable horses, are bred and reared on the eastern side of the country.

When we come to examine the formations enclosed in this area it is found that a large breadth of the country extending from the coast-line inwards is alluvium, and beyond this to the west, chalk and the red sandstones predominate. Another feature about this horse-breeding area is the small number of trees, the paucity of woodland and big fences, and for the most part its flatness.

There can be no doubt that good horses can be, and are, bred on every description of geological formation, other things being favourable, but for obvious reasons those referred to above appear to lend themselves to this class of enterprise much better than do some others.

Limestone we know is greatly extolled, and all other things being favourable, is perhaps the best substratum that can be found for the purpose, but without the "other things" there is little to be said in its favour.

Physical Conformation.—The physical conformation of a country may operate for good or for evil. Hill land is proverbially dry; it affords good "lair", and is so far conducive to health, but, generally speaking, it lacks fertility, and is not so sustaining as that in less elevated positions.

It offers, however, advantages which are of considerable importance to the growing animal. The pasterns acquire slope, elasticity is imparted to the paces, and action is developed. The feet, too, acquire strength, with ample size and good formation.

Hills, however, when too steep, affect brood-mares prejudicially in the latter stages of pregnancy, especially when they are fat and caused to gallop down them.

In these circumstances the fœtus is forced violently forward, and the shock imparted to it may either occasion an unnatural presentation and render foaling difficult, or provoke abortion.

FOOD

From the moment when the mare accepts service to the time when she foals, her food should be ample without being excessive, and carefully apportioned to her work. Good feeding is indispensable to the due nourishment and growth of the fœtus, while feeding in excess of what is required to meet the demand of parent and offspring may jeopardize the health or even the life of both. In addition to good corn and hay, the pregnant mare should be liberally supplied with pulped roots, or, failing them, a daily small ration of bran or linseed, or both.

It should not be overlooked that roots when frosted or decomposed are a standing menace to gestation and a fruitful cause of abortion.

Some mares when pregnant develop a morbid appetite, which prompts them to eat many hurtful things in dangerous quantities. One will take every opportunity of devouring earth, another will consume its own excrement, and others lose no opportunity of ingesting large quantities of litter, both clean and dirty, or drinking filthy water to which they may have access. Where this unnatural desire exists, measures should be adopted to prevent its being indulged.

Many mares are allowed to remain idle during the whole breeding season, and although it is not a commendable practice it is one which cannot always be avoided. In such circumstances many run out in the open pasture during the whole year, and if they are allowed ample range, an open shed, and plenty of good food, it is much to be preferred to cooping them up in stables or confining them together in the narrow limits of a yard.

Besides affording them an opportunity for exercise, an outdoor life fits them and their produce for an early return to pasture after foaling, without incurring the risks incidental to pampering in confinement.

Water.—Nothing is more important to the well-being of breeding-studs than a supply of wholesome water. It is not to be expected, save under exceptional circumstances, that a public service will be available. Ponds, rivers, wells, and streams are the more common sources from which the supply will require to be drawn. Here it will be necessary to look into the details of these sources in all their relations, and particularly as to whence they are fed or replenished, and in what relation they stand to possible sources of contamination with matters prejudicial to health.

Rivers on whose banks manufacturing industries are carried on, are liable to be polluted with various deleterious waste products of manufacture, and the danger to animal health will in such cases be in proportion as the stream is slow and small in volume, or rapid and large. In times of drought, when water is low and sedimentary matters come to the surface and are stirred up by the feet of horses while drinking, the danger is materially augmented, not only as regards chemical substances and decomposing organic matter, but also in reference to parasitic infection. Large numbers of animals are sometimes ruined in health or altogether destroyed by the last-named cause. More than one costly stud, in the experience of the writer, has been seriously depleted in consequence of exposure to ponds infested with the eggs and larvæ of blood-sucking parasites.

Ponds should be periodically cleansed. No trees should be allowed to overhang them, and to obtain the greatest security against mischief they should be fenced off and the water lifted into tanks placed beside them. This is especially desirable during periods of drought, when they are low, and the decomposing sediment teeming with animal and vegetable life is brought near to the surface.

Purity is not a possible condition in nature, and cannot therefore be hoped for, but as far as practicable an ample and wholesome supply should at all times be accessible to breeding-stock and their produce.

Neglect of this precaution has frequently been found by the writer to afford a reasonable explanation of those outbreaks of abortion and infertility which so frequently occur in our large breeding-studs, and it should ever be present to the mind of the breeder that however wholesome water may be at its source and in its course, dangerous pollution may nevertheless result where tanks and troughs are allowed to be fouled by animal and vegetable matters. The periodical cleansing of these

receptacles, therefore, is indispensable to good management and success in breeding operations.

STOCKING AND OVERSTOCKING

Stocking and overstocking are clearly relative terms. The number of animals a definite area of land will carry will of course depend upon the fertility of the soil and its power of sustaining growth through the year, as well as upon the nature and character of the herbage it produces. Horses have a strong predilection for the finer grasses, and from a grazing point of view may be regarded as wasteful feeders. Nothing is more striking than the way in which they will clear the grass off certain patches down to the roots, and continue to graze the ground over again and again, while other parts of the pasture are covered with a luxuriant growth which they altogether neglect. Acreage, therefore, is no absolute measure of the sustaining power of pasture land, but rather the quantity and quality of suitable herbage it produces. It is on account of this residue of rough grass that bullocks prove so useful after horses. They eat off the coarse herbage, and lay bare a fresh succulent bite which horses will attack when there is a shortage of the better kinds.

Among other reasons, it is this partiality to certain parts of pastures which has rendered it desirable to provide a large area of ground for horses to run over. In a pamphlet published by Sir Walter Gilbey on *Young Racehorses*, it is pointed out that "one yearling to every five or six acres is plenty".

Nothing tends so much to the deterioration of pasture land as overstocking with horses. By this is not to be understood the mere placing on it of more horses than it can fairly carry and support, but grazing it year after year without intermission or association with cattle. By this method of treatment the fine herbage becomes less abundant and the coarse rejected variety, remaining to seed, is more largely distributed.

Moreover, if wet or boggy as a whole or in parts, the soil becomes foul, and serves as a suitable environment for the growth and maturation of the larvæ of equine parasites, which, when once introduced, continue to multiply year by year, invading first one animal and then another, until under favourable conditions the great bulk of the breeding-stock become more or less severely infected.

Poverty, stunted growth, infertility, and abortion are among the consequences of this too common mismanagement. Land devoted to horse-breeding should be periodically grazed with cattle or mown for hay, and,

save on limestone or chalk formation, should be subjected to a good dressing with lime and salt.

FOUNDATION STOCK

No man should undertake the breeding of horses who has not first acquainted himself with the natural influences which operate in modifying descent.

He will then realize how difficult it is to obtain a uniform result from what appears to be the same set of circumstances.

He may rely on each variety being true to itself—that shires will produce shires; hackneys, hackneys; thoroughbreds, thoroughbreds, &c.; but he cannot rely on one or another to reproduce offspring of a uniform standard of excellence. Moreover, the same dam and the same sire mated through a succession of years will frequently be found to yield produce essentially dissimilar from each other in form, colour, endurance, and temperament. On this account breeding has been said to be a "lottery", and I do not know how it could be better expressed. Influenced in a large measure by causes which are beyond our control, and which we but vaguely comprehend, the element of chance must necessarily enter largely into the enterprise. Notwithstanding this, there is ample experience to show that the uncertainty incidental to horse-breeding may be greatly curtailed by the adoption of proper methods.

The natural tendency of both animals and plants in the course of propagation is to vary either in one or more of their parts, or as a whole, and this will be more especially the case in those specimens which have been rapidly forced to a higher state of development by artificial selection and treatment.

Beyond this there also exists a tendency, in these improved forms especially, to revert or throw back to a more or less remote ancestor, and in doing so the offspring may depart from the parental type by losing the more recently acquired and much-coveted characters. It is on this account that "back breeding" so forcibly calls for careful scrutiny and consideration in stud-management.

With these facts in view, it is not difficult to understand why produce so frequently differ from each other, and from the parents from which they spring, and why the fundamental belief that "like produces like" is so frequently untrue. Many a breeder has experienced the disappointment of producing an unshapely, worthless brute from an alliance of his choicest stock.

Derby-winners and the commonest of platers have frequently descended

from the same parents. Champions and cup-winners claim family kinship with cabbers and vanners as the result of these reproductive disturbances.

Of course, discrepancies of this kind are not always referable to the causes alleged. Some are brought about by accident or neglect, in which sickness and indifferent feeding and housing play an important part; but the natural tendency to variation, and to revert to ancestors less improved or of inferior type, is accountable for much of the diversity of size, form, colour, temperament, and endurance so frequently encountered in the experience of horse-breeders.

To minimize the risks which must always attend the breeding of animals, and especially the improved races, it should be the aim and object of whoever enters upon the business to procure at the outset some of the best specimens of the variety he wishes to reproduce.

Outward form, however, is not necessarily the passport to success, but with that must be combined the property of *prepotency*, or power on the part of the breeding-stock to impress their meritorious points, size, form, action, power, quality, &c., upon their offspring. This property, largely possessed by certain strains or families, is but feebly exercised by others.

The Danegelt strain of Hackneys, the St. Simon strain of Thoroughbreds, and the Harold strain of Shires are forcible examples of the former, while instances of the latter will be present to the mind of all who have watched the stud career of some noted representatives of these varieties.

It is equally important that this power to impart to the offspring the best qualities of the parent should be as strongly implanted in the dam as it is in the sire, and it should also have existed in the ancestors of both for a succession of generations.

It will be gathered from the above that individual merit alone cannot be relied upon to perpetuate itself, unless fixed in the individual by a long succession of prepotent ancestors.

How often do we see in our show-rings horses and mares possessing the most perfect form and action, whose offspring never rise beyond mediocrity, and for the most part hardly reach that. Such animals are usually examples of extreme variation or reversion, whose high standard of excellence ends with the individual instead of being perpetuated in the race by the force of heredity.

Good characters to be transmitted to the offspring with reasonable regularity must be strongly inherited by the parents from remote ancestors. There must be a deep-rooted faculty in the family for reproducing their best traits of character.

Animals so constituted, when mated together, yield the best results, and by a process of selection the breeder is enabled to grade his stock upward, and thus improve the race.

It must, however, be remembered that this power to reproduce all that is best in conformation and constitution may be equally effective in transmitting any faults which may appear in the one or the other.

Where a weak point is found to exist in the make-up of a breeding animal, care should be taken to mate it with one which is not only strong in that particular respect, but descended from parents in whom the required quality was also a conspicuous feature. Only those who realize the importance of back breeding and its influence in shaping the offspring can hope to make breeding a profitable enterprise.

EARLY MATING OF MARES

At what age mares should be put to the stud has always been a question around which much controversy has gathered among breeders of horses; but whatever differences may exist in the matter of opinion, there can be no doubt as to the very general practice in vogue, which allows them to commence their stud career at two years old. This system of early mating is more prevalent among breeders of pedigree stock than among those who engage more especially in the production of trade horses. The latter recognize the physiological truth, that the highest development is reached where the nutritive resources of the system are devoted exclusively to its own maintenance, and not shared by the growing fœtus, the main object being to encourage growth and development, and produce a horse with size, substance, and constitution.

Pedigree, and the glamour of family fame which attaches to it, too frequently prompts the indiscretion of breeding from babies, and the demand for special produce may, from a commercial point of view, justify such a course; but no one with any knowledge of the laws of life can doubt that to impose upon a mare the task of reproduction while actively engaged in building up her own frame, and to ask her subsequently to support her offspring, is a certain means of retarding her growth, if it does not also enfeeble her constitution. Those who care to take the risk of putting mares to the stud at two or three years old, should at least exercise some judgment in the selection of subjects for the purpose.

They should be forward in growth, and at the same time well furnished for their age, and in good condition.

They should not come to the horse until late in the season, and from

the time when they are served to the day when they foal down, and onward to the weaning period, a liberal ration of corn, regulated according to the season, should be allowed them.

An open yard, with a well-littered shed for protection, and a run out in the course of the day if convenient, are the most suitable conditions for winter quarters.

While making these suggestions, the fact remains that the practice is a bad one at best, notwithstanding that examples of the contrary may

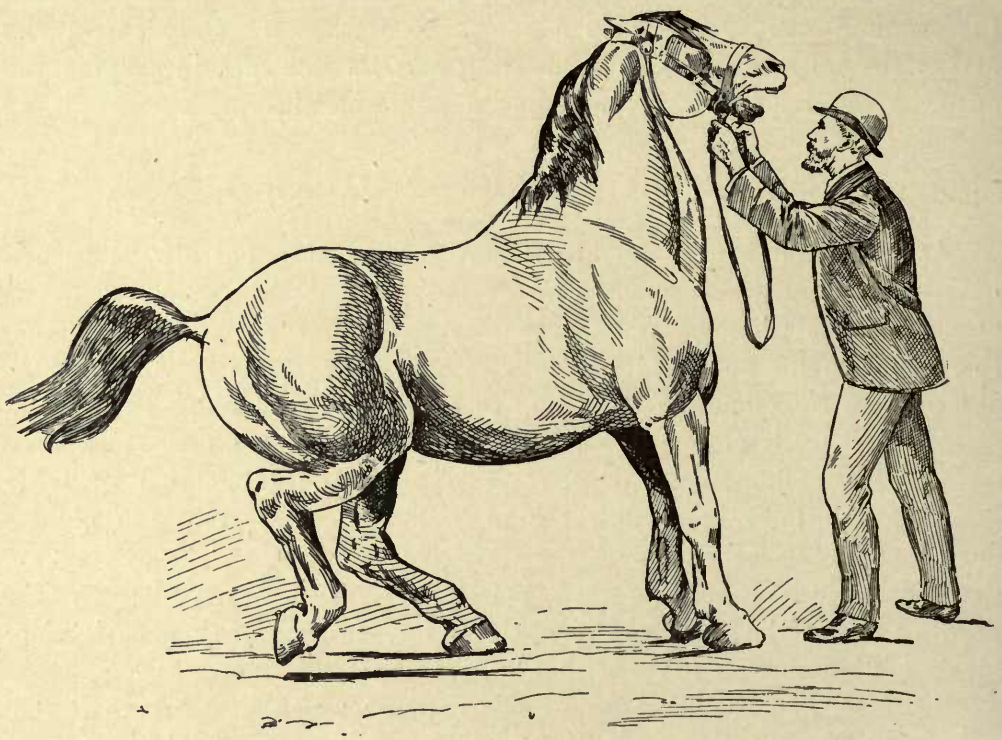


Fig. 533.—A Shiverer

be found in every variety of our horse stock. "That grand horse, Bury Victor Chief, for which Mr. Wainwright paid 1500 guineas, was the produce of Bury Daisy at three years old, and among the Hackneys such famous examples of the breed as Garton Duke of Connaught, Langton Duke, Langton Performer, Vigorous, Astonishment, Orange Blossom, and Dorothy Derby II were all from three-year-old mares.

"But of the huge total of animals so bred, those which have achieved fame in the ring and at the stud form a very small proportion, and lend no sort of encouragement to the adoption of early breeding as a general system."

It is in the interest of the race, no less than the breeder, that mares

should not commence their stud career until they are four years old, when growth is being completed, and when the organs of reproduction have reached their full development, and the physiological energy of the system is well-nigh disengaged from the task of building up the frame, and can be more effectually devoted to maturing the fœtus.

The great bane of the breeding-stud—hereditary disease—must be jealously guarded against, and in this connection much assistance may be derived from the careful study of family history.

It should, however, be kept in mind that many ailments are acquired as the result of accident, which in their outward form are indistinguishable from those which are hereditary.

Sprains, curbs, ring-bones, side-bones, roaring, whistling, string-halt, shivering (fig. 533), specific ophthalmia, and cataract are the most damaging of the many hereditary affections to which horses are liable, and whenever they appear, heredity should be suspected, unless evidence to the contrary is forthcoming.

MANAGEMENT OF IN-FOAL MARES

Feeding.—Not the least important branch of stud-management is that which deals with the care and protection of mares during the period of pregnancy, and it is not too much to say that a considerable percentage of the sickness and mortality ordinarily prevailing in our breeding-studs results from causes of a common and preventable character. Of these, some are especially conspicuous, and perhaps none more so than the prevailing and rapidly-extending system of undue feeding, fattening, and pampering, to which mares of the heavy breed are subjected in the course of their show career.

This is an evil so obvious to anyone concerned in horse-breeding, and so universally admitted by all, that neither evidence nor argument is called for here. Were it otherwise, ample testimony would be found in the stud-books of our heavy breeds. Here it is clearly shown that the productiveness and breeding merit of our great champion mares stand at an almost irreducible minimum, and the limited number of successful produce among their offspring is such as to leave no doubt as to the pernicious effects of the "getting up" and "letting down" to which they are subjected, in the course of their show career. The obesity in which the great bulk of our show mares are found during the exhibition season is a state altogether inconsistent with the exercise of the full measure of their productive powers. With every organ in the body encumbered with fat and impeded in function to the verge of disease,

it would be strange indeed if the fœtus did not suffer in point of size and constitution. Nor does the mischief of this injurious practice end here, for the danger to both dam and foal where any impediment to parturition arises is multiplied manifold, firstly by diminishing the room naturally available for the passage of the fœtus, and secondly by lowering the vitality and strength of the dam, and adding to the difficulty of delivery. It is not only in these immediate effects that this practice proves hurtful, but long after it has been discontinued, sterility, or a disposition to abort—one or the other—is often left behind, while the capacity to reproduce in the offspring that vigour of growth and frame which characterizes the parent is frequently weakened beyond recovery.

Good general health is unquestionably the bodily condition most conducive to productiveness in the dam and growth in the young, and this state can only be acquired and maintained in its fullest measure by a judicious system of liberal feeding and apportionment of suitable work. It must, however, be recognized that while the former may, and should, be within the reach of all who aspire to horse-breeding, the latter is, for obvious reasons, impossible of universal adoption. Mares kept exclusively for breeding purposes lead a life of idleness—in what is usually but erroneously regarded as a natural state. As to pasturing brood-mares much might be said, but it will be sufficient to note the chief points in which it may fail of success. Not the least important of these is the nature of the country. Steep hills and rough ground should certainly be avoided, and especially so where the mares are big and roomy, and in all cases when pregnancy is far advanced. Very naturally, to any suggestion of this kind may be opposed the condition of mountain ponies. Mountain ponies, however, are neither big nor roomy, nor are they highly bred, nor highly fed, nor highly domesticated. Their susceptibility to outside impressions cannot be compared with that resulting from the long years of cultivation and artificial treatment of our improved breeds. Besides, there is no evidence to show that even these denizens of the mountains do not suffer as breeding animals from the physical conformation of the country they inhabit.

Of still greater importance to the well-being of the brood-mare is the nature of the soil from which she draws her sustenance. That best adapted to stud purposes is such as will neither fatten nor starve, but supply a steady growth of herbage of a sound and nutritive character throughout the greater portion of the year. Low-lying, damp situations, where the grass comes sour and rank, where the soil is wet, and dense fogs prevail in the cold nights of spring and autumn, are alike conducive to abortion and prejudicial to health. At all times the winter grazing

of pregnant mares needs considerable care and attention on the part of the manager, and the resort to dry, nourishing diet should not be too long delayed. When it should be commenced will depend upon the nature and quality of the herbage, the size of the pasture, the number of stock upon it, the state of the season, and, above all, upon the condition of the mares. The last-named should never be allowed to get low. Poverty on grass is the worst form of poverty, not only because it is usually attended with exposure, but also because of the tendency which the cold indifferent herbage of the autumn and winter possesses of lowering the temperature of the body. This kind of treatment not only predisposes to abortion, but at the same time retards the development of the fœtus, and tends to impair its vitality and render the foal an easy prey to any disease that may overtake it at the period of birth.

Work.—The view may not be universal, but it is generally held that nothing conduces so much to the production of strong, healthy offspring as giving the mare a reasonable amount of work, under judicious management. A certain element of risk, it is true, always attends the active employment of pregnant animals, and especially those engaged in farm-work, but with common care this is far outweighed by the benefits conferred on the dam and produce. When mares have well-proportioned work and a liberal supply of good food, foals are not only dropped bigger and stronger, but they resist the exposure to adverse influences, and thrive and grow much better than those from idle, ill-conditioned mares.

As to the stage of pregnancy when mares should cease to work, different people entertain different ideas, but the question is surely far more one of management than of opinion. It is common enough for mares to work right up to the time of parturition, and especially among little men, who depend for their livelihood on the labour of their mares. But in these cases self-interest lends its force to management, and largely determines the success of the enterprise. As a general system such a course would be fraught with the greatest danger, but there can be no doubt, where common care is observed in the selection and appointment of work, together with good general management, pregnant mares are all the better for working up to within three or four weeks of the time of foaling. When work is discontinued, daily exercise should be substituted, or, if available, some brief, light employment. The late Mr. James Martin—a rare authority, by the way, on blood and breeding—once observed to the writer: "I have foaled eighteen mares this season. All have worked nearly up to the time of foaling, and without a mishap to either mare or foal." Such a result is not likely to be of common attainment, but it is most assured under the influence of reasonable,

well-regulated work, and generous but careful treatment. In-foal mares should, however, be guarded against severe exertion, such as drawing heavy loads in deep ground or on hilly roads, or backing, or trotting at fast pace, especially down hill, nor should they be made to undergo long fasts or suffer fatigue. As pregnancy advances, and the calls of the growing fœtus on the nutritive resources of the dam become more and more considerable, so should the amount of work demanded of her be diminished, and the food-ration undergo suitable adjustment. To assert that the observance of such details should be among the commonplaces of every stud is only to suggest a state of things that, to say the least of it, is far from universal, technical education notwithstanding.

Stabling.—In the stable, pregnant mares should be provided with plenty of room to permit them to lie down and extend themselves over a good bed of soft litter. The floor of the stable should not slant too much in a backward direction. When separated by bails, their companions should be quiet and free from vice. Breeding-mares, however, never perhaps do better than when turned into the crew yard at night, with a dry shed for protection from the weather, and plenty of dry litter, providing they are on good terms with each other. Our cold and changeable climate has often been urged against this exposure of working animals, but experience teaches that, with an adequate food-supply, the open yard is far more conducive to health than the atmosphere of the average stable, which is usually made filthy by the studious exclusion of outside air and the deliberate confinement of that which is within. Moreover, the denizens of the open yard know nothing of those extremes of temperature, the sudden alternations of which are so fruitful of disease; and while being at all times fitter for their work, they are also much less susceptible to sickness than those which spend their nights in the stuffy, filth-laden air of a stable deprived of all means of ventilation.

When the weather permits, this kind of management allows of the mare's being turned to grass for a few hours each day during the later weeks of pregnancy, without the risk attaching to animals more closely stabled. A bite of spring grass, before parturition, prepares for the more complete change of food which is shortly to take place, and protects the foal from those often fatal attacks of diarrhœa, which result when mares are suddenly transferred from hard corn to pasture—from the close stable to the open field.

WHEN FOALS SHOULD FALL

To regulate the mating of mares so that the foals shall be dropped at a suitable season is a matter of the greatest concern to the breeder of horses. In these days of horse shows, with their numerous and costly prizes, medals, championships, and challenge cups, great temptation is offered to the breeder of pedigree stock to strive after early produce, and resort to a system of forcing and pampering which, while productive of a limited and temporary success, cannot be otherwise than disastrous to the general well-being of the horse. As to the particular month of the year when foals should be encouraged to come, a great deal will depend upon the soil, locality, and climate in which they are to be reared, and, naturally, opinions on this question vary with the variations of experience gained under different local conditions. In a climate so uncertain and trying as ours, early foaling is distinctly prejudicial to the life and health of the offspring, and it is not too much to say that a large share of the loss and disappointment that breeders experience under ordinary conditions is due to this cause. Some consider the advantage of an early colt to be a good set-off against the risk entailed, and the latter part of February or the beginning of March is the time arranged for foaling to commence. With the prevailing winds from the east or north-east at this season of the year, cold rains and snow-storms, little sunlight, and a scanty supply of rank herbage, both mare and foal must either be subjected to confinement for several weeks, or face the rigours of the season and attendant risks. Nothing conduces so much to the health and well-being of the dam, and to the growth and stability of the foal in the first period of its life, as an abundance of spring grass and the vivifying influence of the solar rays.

These desiderata cannot be hoped for as a settled condition until the month of April has well advanced, and it is from this time onward, through May and June, that the best and strongest foals will be dropped, and most successfully reared. The best food that can be procured, and the most perfect stable and management that can be designed, are poor substitutes for the liberty, pure air, and rich succulent herbage of advanced spring.

Foals dropped late in the summer are at an equal disadvantage with those that appear too early. The grass at this time is losing its goodness, and the milk of the dam is indifferent both in quality and quantity. Besides, the nights are getting cold and damp, and, worse than everything, the youngster will be shedding its coat at a time when it should possess its winter suit. All this tends to lower the vitality of the individual, to check growth, and enfeeble development. If foals are to grow, and shape, and

make good horses, they must bask in the sunshine of summer, and receive an abundant supply of the rich milk and ripe herbage it affords. Moreover, growth, to be attended with substantial development, must be continuous, and uninterrupted by the poverty and inclemency of both spring and autumn.

Light land districts where the soil is dry, the climate temperate, and the site protected, are the most congenial to early produce, but under the most favourable conditions early foals should only be turned out when the sun shines, and where shelter, in the shape of a comfortable shed, is provided.

THE FOAL AT BIRTH

The bowels of the foal at birth contain a considerable amount of fæcal matter, consisting of the solid remains of bile, and other secretions thrown out by the mucous membrane of the intestines during fœtal development. Usually this is discharged soon after birth as a soft greenish or yellowish brown fæculent substance. In some cases, for reasons which we cannot assign, this material becomes hard and dry, and is unduly retained.

The foal is noticed to keep raising the tail, arching the back, and posing as if to dung, and now and again straining without effect. Here a little timely help is needed to clear the bowels of their hard contents. For this purpose an enema of warm glycerine and water may be injected into the bowel, and repeated, if necessary, two or three times during the day. Should this fail to effect removal of its contents, a small dose of castor-oil should be given without delay, in a little warm fresh milk. If the constipation becomes habitual in the foal, the dam must be allowed an extra supply of carrots or green food, and a couple of ounces of sulphate of magnesia mixed with the food every day for three times.

Foals, when born before the full term of gestation has been reached, are sometimes discharged enveloped in the fœtal membranes or after-birth, and, as they are then disconnected from the dam, respiration is only possible by exposure to the external air; it is necessary, therefore, that the membranes be promptly removed. This having been done, breathing may be set in motion by a little artificial respiration, sprinkling the face with cold water, or the application of a smelling-bottle to the nose.

It is of the first importance that the after-birth be promptly removed from the box and buried in some unfrequented place, and sufficiently deep to guard against its being exhumed by dogs.

The milk of mares which foal prematurely is always scant and of indifferent quality for the first two or three days, and may require to be supplemented by milk from another mare or from the cow.

At the time of birth and for some time afterwards, foals often present an unshapely and awkward appearance. Their hocks or knees, or both, are acutely flexed, and their fetlocks may almost touch the ground. The limbs give the impression of being incapable of supporting the weight of the body (Plate XL). In many instances the advice of the writer has been sought as to whether animals so deformed should not be destroyed. It should, however, be remembered that where there is no bending of bones, or shortening of ligaments or tendons, the foal invariably "straightens up", and the deformity gradually disappears as growth proceeds. In those cases where the bending of the joints is due to contraction of the tendons, the defect may be remedied by mechanically stretching, or dividing the latter by a surgical operation.

FOALS PREMATURELY BORN

When foals come before their time, they lack the finishing touch in the work of development, although every organ may be fully represented in all its parts and relations. The prospect of rearing these immature youngsters will depend upon the period of gestation which has been reached when they are born, and the strength and vitality they display at the time.

In all cases they require the greatest attention and care, and in some, however anxious we may be to preserve life, the task is hopeless from the first. This is especially so when birth takes place four or five weeks before the natural period.

Foals prematurely born are, from their ill-developed condition, small, and, being too weak to stand, are unable to feed themselves. They display a great desire for sleep, and it is of the first importance that every encouragement be given to its restorative influence. For some time the breathing will be more or less quick, and to the uninitiated may give the idea of some grave lung disease, but under judicious management a gradual subsidence will take place as time goes on, until the normal standard of breathing is reached.

Being helpless, a foal prematurely born should be removed from the presence of the mare as soon as it has been thoroughly cleansed, and conveyed into a warm, dry apartment, where, if necessary, artificial heat must be supplied.

Laid on a soft bed of hay, and covered by a couple of blankets, it should be left undisturbed for half to three-quarters of an hour, when the mare must be milked, and the produce given to the foal out of a feeding-bottle. This must be repeated every half-hour, with the precaution that the vessel used for receiving milk from the mare and the one employed in feeding

the foal should be thoroughly scalded, drained, and dried in the oven each time after being used. Before the mare is milked, the teats and udder must be cleansed, and sponged over with a solution of carbolic acid.

Unless these precautions are strictly observed, and the milk conveyed fresh to the foal directly it leaves the dam, it will be impossible to guard against diarrhœa, and when this disease is once established in these imperfectly developed youngsters, a fatal termination is mostly the result.

Hand-feeding will require to be continued night and day until the foal is strong enough to feed itself, but after the first thirty-six hours the period between meals may be gradually extended.

When it has acquired sufficient strength to support itself, it may be returned to the dam. How it will be received by her is a question which must not be overlooked, and the attendant should stand by until the mare has settled down to her offspring and shows a desire to nurse it.

If, as is most likely to be the case, the dam is short of milk, the deficiency must be made up by milk from the cow, prepared as directed below.

HAND-REARING OF FOALS

It sometimes happens that the udder of the dam is functionally destroyed, or so far damaged as to be incapable of producing a supply of wholesome milk, or the dam may die and leave the offspring to be reared by foster-mothers or by hand.

To procure a foster-mother is always a difficult task, and sometimes a most costly one. It does, however, now and again occur that a mare will lose her foal, and a foal will lose its mother, about the same time in the same district, and in these cases it is a mutual, if unequal, advantage to the persons concerned to bring the survivors together. When this can be done, the trouble is in a large measure removed, although it must be admitted that the transference of a newly-born foal to a strange mare is not unlikely to be attended with digestive disorder and diarrhœa at first, and especially if the former has not received the first laxative milk of its dam, and the latter should have foaled several days prior to entering upon her fostering duties.

As to whether hand-rearing is a desirable course to pursue, this will very much depend on the age, character, and breeding of the offspring. The more youthful it is when deprived of its parent the greater amount of trouble it will give, whether its other properties be good, bad, or indifferent; and those who undertake the task of ministering to the wants of these unfortunate youngsters must be prepared for no inconsiderable sacrifice of time, to say nothing of comfort, as well as for inconvenience and expense.

Failing a foster-mother, the next best source of food-supply is the cow. Here again some consideration must be given to selection of a suitable subject whence to obtain the milk, for if the task of hand-rearing is to be undertaken, it must be entered upon and pursued in such a way as to safeguard success at all points.

The most suitable milk for this purpose will be obtained from a heifer a week after calving, or if the foal has not sucked its dam it would be an advantage to procure a supply for the first thirty-six hours from a cow just calved, in order to awaken the action of the bowels and provoke discharge of their contents.

Once having commenced with the milk of a particular animal, it is most desirable that no change be made, if possible to guard against it, and, as we have previously observed, the milk of a young cow freshly calved is much to be preferred to that of a stale old one.

Although, as will be seen from the figures given below, the same constituents are found in the milk of the cow as enter into that of the mare, the actual and relative proportions of these constituents differ to a considerable extent in the two cases. To approximate the composition of the one to that of the other, and to render it more suitable to the requirements of the foal, water must be added to reduce the proportions of casein and fat, and at the same time the deficiency of sugar must be made up by the addition of a suitable quantity of the domestic article. At first the proportion of water to cow's milk should be one part of the former to two of the latter, but as time goes on one part to three will be found more to the purpose, and later water may be excluded altogether. The following figures are percentages:—

	Cow's Milk.	Mare's Milk.
Water	87·0	88·0
Fat	4·6	1·0
Casein	4·0	1·6
Sugar	3·8	8·9
Salts	0·6	0·5

Thus it will be seen that while the fat and casein of the cow's milk is largely in excess of that of the mare's, the sugar of the mare's milk far exceeds that of the cow's.

Next in importance to a judicious selection of milk is the desirability of its being transferred immediately from the cow to the foal while still warm. To maintain the natural temperature (100° F.) it should be drawn from the cow into a vessel previously warmed, and afterwards diluted with water raised to 100° F. Cold stale milk at this tender age is sure to provoke diarrhœa, and not unlikely to bring about a fatal result. Cleanli-

ness in the vessels used and the handling of the milk should be strictly observed, and, above all, its administration must be frequent and regular, both as regards quantity and time. At first half a pint should be given every half-hour, and gradually increased as time goes on, while the intervals between meals may be extended accordingly. It must be remembered that to be successful the indications of nature must be closely observed and acted upon. Neglect in this matter can have but one result, viz. failure.

In commencing this system of rearing from birth, attention should be directed to the state of the bowels at the outset. Should the foal not have received the first milk of its dam, constipation is more than likely to exist, and should be corrected by the administration of a small dose of castor-oil and an enema of glycerine and water. Where the milk of a newly-calved cow can be procured, its purgative properties may be sufficient to unload the bowels, in which case further interference becomes unnecessary.

USE AND ABUSE OF COW'S MILK

To supplement the milk of the mare with that of the cow as a means of raising foals is in certain circumstances both desirable and necessary. Fillies with their first foal frequently fall short of an ample supply to keep the sucker growing, and especially is this the case after a hard winter on indifferent fare. At this early period of life the mare is building up her own frame at the same time that she is nourishing her offspring. The mammary gland has not yet reached its full size, and as a milk-making machine it has not developed a high functional activity.

Mares advanced in years before being put to the stud, as well as those which have bred on to the decline of life, and others constitutionally weak, frequently fail to yield the necessary measure of milk for the support of their offspring. The same result may follow upon an injury to the mammary gland, by which its functional activity becomes in a greater or less degree curtailed. Nor is the question of the nourishing power of the dam's milk always one of quantity. The writer calls to mind several instances where foals have starved on what appeared to be an ample supply, but which was subsequently found to be of the most indifferent quality.

In these circumstances a little help from the cow, until the youngster can forage for itself, may make the difference between a valuable and a useless animal—between a serious loss and a substantial gain to the breeder. We must, however, condemn that pernicious system so much adopted towards foals preparing for show, of allowing them an unlimited supply of cow's milk not only before but long after they are weaned. There is no doubt that by this treatment a spurt is given to growth, size is materially

increased, and so long as the allowance is continued and the balance of health upheld a vigorous growth is provoked and maintained—in other words the animal is "forced". It is in this way that many of the foals and yearlings that take champion rank at our various shows are built up. But how many fall victims by the way, and fail to realize the hopes and aspirations of the too ambitious owner, is only known even approximately to those whose business calls them to minister to the unfortunates.

Diseased feet, overshot joints, bog-spavins, and wind-galls, to say nothing of the constitutional break-down which sometimes follows upon a discontinuance of the milk diet, are the too common consequences of this hurrying treatment.

It is not the intention of the writer to condemn the use of cow's milk in the rearing of foals where circumstances call for it, but to caution the breeder against its abuse, for when the ailments indicated above are brought into existence by this forcing system, they not only occasion immediate disappointment, but frequently continue, and result in deterioration and loss.

WEANING FOALS

The longer a foal can have the easily assimilable milk of its dam the better horse it will make. But for various reasons mares are but seldom permitted to wean their own foals, partly because they are required to take part in the work of the farm or to be used for riding or driving purposes, and partly also because they have again been put to the horse and are building up another fœtus. Although these several duties are capable of being performed within certain limits without ill effects either to parent or progeny, when pushed too far they are likely to prejudice the health of both. As the fœtus of the pregnant mare increases in size and attains to higher development, suckling can only be carried on at a disadvantage to the former, and a heavy drain on the nutritive resources of the latter.

Foals are usually weaned about September or October, when they are five or six months old. At this period of the year, nights are getting cold and damp, pastures are on the wane, the milk-supply is falling away, and if the mare has been to service her fœtus has made considerable growth and requires all her support.

Where, as the result of constitutional weakness or debility, from backward growth or any other cause, it is considered desirable that the foal should continue with the dam for an extended period, then both should be allowed an ample supply of corn and chaff, and any demand that is being made on the mare in regard to work should cease.

Animals when called upon to extend the period of suckling, should be taken up early and put into a well-littered yard, and have the protection of an open shed.

In all cases the foal should be well "done" with corn, bran, and chaff for three or four weeks before being weaned, so that the loss of the mother's milk may not be so severely felt.

As to whether the separation of the foal should be made completely at once, or by allowing it to return to the mare at increasing intervals, is a matter upon which breeders are not by any means unanimous, some adopting the one course and some the other, with equal success and satisfaction. We think, however, that a gradual intermittent process of weaning is most rational, and best adapted to safeguard the health of both dam and offspring.

For some time after separation takes place the mammary gland of the dam continues its secreting function, and in the case of mares in whom lactation is very active may cause painful distension of the udder. To avoid this, the quantity and milk-forming quality of the food supplied to the dam should be reduced, and only a moderate measure of water allowed.

After weaning, foals should not be allowed to "go back" in condition, but should be kept growing by a liberal ration of manger food and good pasture.

The restlessness resulting from separation from the dam will be greatly appeased by company, and especially by two or more foals being turned out together.

THE MARE AFTER FOALING

To safeguard the foal it is necessary that every attention be given to the mare after parturition.

Old matrons which have passed through the ordeal again and again, and are familiar with the duties of their office, seldom call for interference. With young mares, however, fresh to the business, certain special precautions require to be observed. In the first place, the teats should be examined as to their permeability. In some instances there is no opening for the escape of milk, and the foal pines, and is sometimes reduced to the verge of starvation before the defect is discovered.

So long as the excitement resulting from foaling continues, strangers should not be allowed access to the stables, and the man in attendance should be one who is best known to the mare, and who has been in the habit of feeding and tending her.

When the excitement of parturition has passed away, and the foal has gained its legs, it will soon commence to seek for the teat, and it may be

sometimes desirable to direct it to the gland. This, however, should not be attempted too soon, for the natural instinct of the little creature will sooner or later guide it to the source of its food-supply.

Young mares are liable to injure their foals by treading upon them before they "get their legs", but this is frequently brought about by the over-anxiety and untimely interference of the attendant. Strong foals quickly rise to their feet, and require but little interference. Weakly foals, on the other hand, or those prematurely born, make many ineffectual attempts to rise, and in doing so are liable to fall in the way of the dam and suffer injury. It is in these cases that special watchfulness and care are required. Here the attendant should allow the foal plenty of time, and wait until it is able of itself to rise. It may then be supported and assisted to the teat.

For the first twenty-four hours after foaling, the mare's diet should be carefully selected and adjusted as to quantity. At first, warm oatmeal or linseed gruel is the most suitable; and if parturition has been troublesome and prolonged, and there is evidence of exhaustion and weakness, a pint of good ale should be mixed with it and repeated in two or three hours, or failing that, 4 to 6 oz. of whisky may be substituted. A little scalded bran and crushed oats may follow, and later a liberal quantity of nourishing diet, of which green stuff should form a large proportion.

After the mare has cleansed and drained, the soiled straw should be removed from the foaling-box and the floor well swept and disinfected. For several days a certain small quantity of discharge will flow from the genital passage and soil the tail, and maybe the udder and teats, and in a putrid condition this may find its way into the stomach of the foal, and occasion diarrhœa of an obstinate or even of a rapidly fatal character.

Many of those attacks of this disease of obscure origin, and which are attributed to all sorts of possible and impossible causes, arise out of the ingestion of decomposing filth, taken in the act of suckling. Not only may this poisonous stuff besmear the udder, but it may also be transferred to it by the filth-laden tail, or be gathered from the sodden litter on which the mare may lie.

To avoid danger to the foal from this cause, the udder should be sponged from time to time during the first few days after parturition, and the tail of the dam should also be thoroughly washed and cleansed. These precautions are especially necessary in those cases where foaling has been difficult and has called for assistance, and the discharge has been considerable.

For the first two days after foaling, both mare and offspring should be protected from cold and wet, and especially from exposure to easterly and

north-easterly winds. As, however, they will soon require to be turned out to grass, overheating of the stable requires to be strictly guarded against by free but carefully regulated ventilation.

Neglect of these precautions sometimes conduces to serious, if not fatal, pneumonia.

To keep a foaling-box too cold is pardonable, to overheat it is culpable. As soon as the weather permits, both mare and foal should go to grass. In turning them out for the first time, that part of the day should be selected when the sun is out, the wind in a favourable quarter and not too brisk, and when the ground is fairly dry. After confinement, foals in their gallops and gambols often become overheated, and in a state of fatigue throw themselves down on the wet, cold ground, or stand about in a biting wind, causing serious, if not fatal, consequences.

In the early spring the weather is prone to rapid and extreme changes, and bright warm sunlight is often followed by piercing winds and driving rains; and with these adverse forces to contend with, the careful studsman will arrange his first turn-out within easy reach of shelter and protection. This will not be needed long, for foals soon adapt themselves to an outdoor life.

Even when a turn-out is not desirable, foals should be provided with plenty of room to move about, and have in addition forced exercise under shelter of a shed. A little movement helps to straighten up a foal and put him fairly on his legs.

When the turn-out comes, it will require to be considered as to how far grass should be supplemented with manger food. This will, of course, depend a good deal upon the state of the weather, the nature of the soil, and the stage of growth of the herbage. Cold weather, with a shortage of grass, will call for a liberal daily ration of dry food.

Young mares which enter upon their maternal duties at three years old, and old ones whose yield of milk is insufficient, should always receive a couple of feeds of crushed oats daily for two or three weeks after being turned out, or until the grass comes to its best.

In both these circumstances the foals should be encouraged to eat manger food with the dam, so that any lack of milk-supply occurring as the season advances may be met by a further addition to the corn ration. Without this precaution the foals of young growing mares, and those of old ones whose vitality has been lowered by age and hard work, seldom make good growth and develop size and constitution.

Mares with foals at foot should have good range of pasture, and in addition an occasional change is most desirable.

STERILITY

It would seem that sterility in the female must depend upon one of several causes. The ovaries may be incapable of forming eggs, or the eggs when formed are defective and incapable of fertilization. The ovaries, on the other hand, may be functionally perfect, but owing to some obstructive condition of the Fallopian tubes or oviducts they fail to reach the uterus. Again, a perfectly healthy ovum may be impregnated and safely conveyed to the womb, but unless that organ is in a normal condition it may die, conception would not take place, and the mare would as a consequence fail to breed.

The writer has known several instances where the entire structure of the egg-forming glands have been destroyed by the growth and expansion within them of cysts or bladder-like formations (fig. 527), and other cases where the glands have been rendered functionally useless by the development within them and round them of malignant tumours. The Fallopian tubes may be rendered impervious by pressure from without, or by thickening of the membrane lining them, or by morbid growths within them or upon them. Mares which have passed through a period of difficult foaling not unfrequently become sterile owing to the Fallopian tubes getting blocked up by inflammatory products, or so far thickened as to obliterate the passage and prevent the ovum from reaching the uterus.

However perfect the ovaries or oviducts may be, impregnation cannot take place unless the semen of the male gains access to the uterus, for which purpose it is necessary that the entrance thereto should be open to receive it.

Obstruction at this point is not unfrequently the cause of sterility in mares, either as the result of a twist of the neck of the uterus, or a thickening of its walls, or disease of the mucous membrane, any one of which may obstruct the passage and prevent the entrance of the sperm element into the womb.

From these considerations it will be seen that the possibility of restoring fruitfulness in the sterile mare will depend upon the nature of the cause to which the sterility is due. Of these some are amenable to treatment, but others are altogether incapable of being removed. While it would be impossible to restore the function of an ovary or egg-gland whose structure had been broken up and absorbed by the growth of cysts or some other formation within it, it might not be difficult to remove or overcome an obstruction in the neck or mouth of the uterus, or, in some cases, to restore its lining membrane to a normal condition.

In order that an impregnated ovum may proceed to develop into a fœtus, the womb with which it must establish a connection will require to be in a healthy condition. Many mares fail to breed, not from any structural defect of the reproductive organs, but from a functional derangement of the mucous membrane of the uterus or vagina, whose vitiated secretion imperils, if it does not immediately destroy, the life of the spermatozoa, or should they escape and impregnation take place, the fertilized ovum sooner or later succumbs to its unhealthy environment. Many of those cases where mares return to the horse and receive service again and again without proving fruitful, result from some one or other abnormal state of the uterus unfitting it to nurture the impregnated germ.

Although little can be done to rectify those graver structural defects of the ovaries and the uterus which add to the prevalence of sterility, much may be done to prevent that greater waste resulting from obstructive conditions affecting the mouth and neck of the womb, which prevent the semen from entering it.

It has repeatedly been affirmed and implied that in the act of coition the spermatic fluid of the horse is deposited in the vagina of the mare, and that the spermatozoa subsequently enter the uterus by virtue of their own powers of movement or are sucked into the latter organ during its relaxation, when copulation is completed. While allowing the operation of both these forces in the act of insemination, it is impossible to disregard the mutual adaptation of the male and female organs to the purpose of conveying the semen directly into the mouth of the womb. The projection of the urethral canal beyond the glans penis in a state of erection would seem to indicate that this arrangement was designed to ensure the delivery of the male element into the mouth of the uterus.

That this should take place is not absolutely necessary to fertilization. It has been proved by experiment that the injection of semen into the vagina alone may be sufficient to induce pregnancy. Because this is so, it has been argued that the spermatic fluid in the act of copulation in the horse is not discharged into the uterus. It seems to the writer that such a conclusion is not warranted by the facts.

That the introduction of semen into the vagina is followed by pregnancy does not exclude the possibility of its being deposited directly into the mouth of the womb during the act of coition, but would rather appear to afford a supplementary provision for impregnation in the event of this not being effected.

Whether insemination is brought about by one method or the other, or both, a clear entrance to the uterus is an indispensable condition to impregnation by natural means.

ARTIFICIAL INSEMINATION

As obstructions of one kind or another are frequently encountered, it has been found necessary to resort to artificial methods of insemination in those cases where the hindrance can be overcome and a passage forced into the uterine cavity.

For many years it has been the practice with some stud-managers to pass the fingers into the uterus of mares which failed to breed, before putting them to the horse, the object being to open the passage for the entrance of the seminal fluid, and in many instances with the result that pregnancy has followed the service.

In untutored hands this method of clearing the way has sometimes been

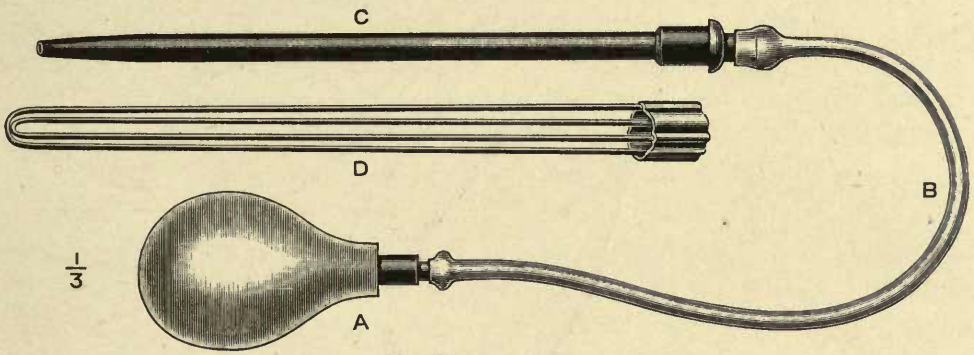


Fig. 534.—Inseminator

A, India-rubber bulb; B, flexible tube; C, nozzle; D, guard, to prevent choking of the nozzle.

followed by bad results, but when properly performed it is quite a harmless and simple operation. One more safe and reliable, however, is to resort to artificial insemination. This is effected by means of an instrument (inseminator) designed to collect the semen of the male from the vagina of the female after service, and transfer it directly into the uterus. The practice has been largely adopted by breeders, and with a considerable amount of success. Among the earlier examples of its value in this country, was the yearling filly "Sandflake", the daughter of "Trenton" and "Sandiway", which, at the dispersal sale of the stud of the late Duke of Westminster, was sold by auction to Mr. Sievier for 5500 guineas. This filly was the result of conception following upon artificial insemination.

In America the operation had been practised on a considerable scale for many years, and to a less extent in France, Germany, Russia, India, and other countries, before its adoption in these Islands was at all general.

Mares which have been to service again and again year after year

without being impregnated by natural means have at once been rendered fruitful by artificial insemination. Thus valuable animals, relegated to the drudgery of the farm as lost to the race, have been restored to the stud, and converted into valuable assets. The advantage of this mode of propagation is not alone that it overcomes the impediment to insemination in the mare and renders her fruitful, but by reducing the work of the sire his strength and vigour are conserved, and his services become more effectual.

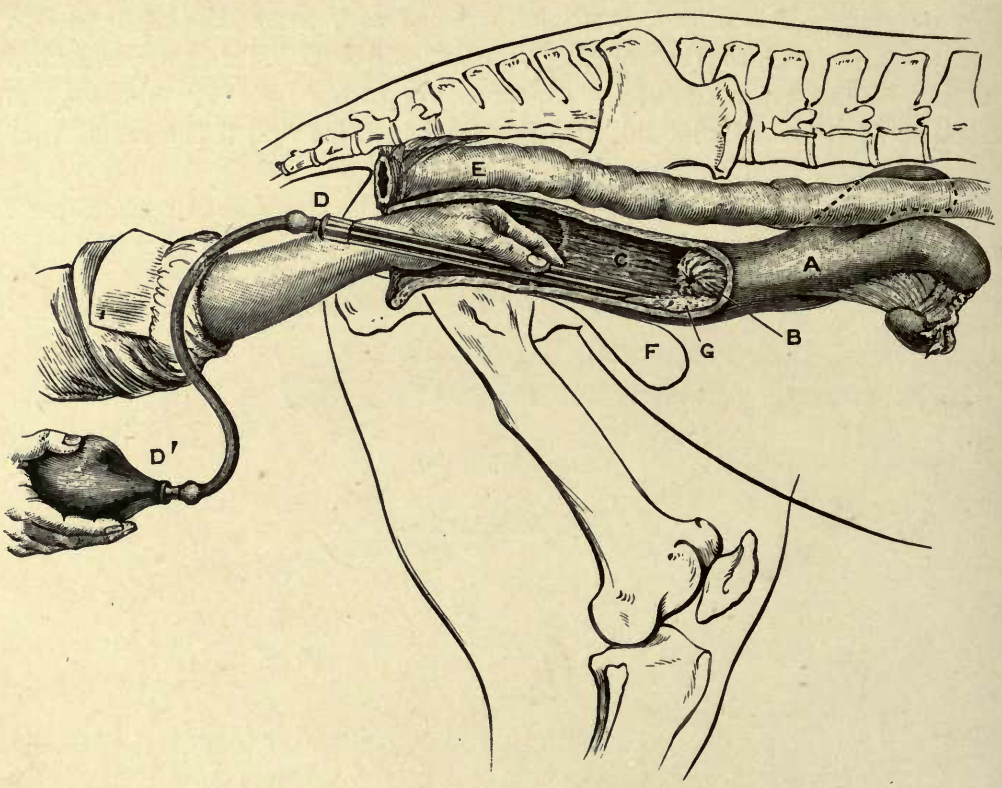


Fig. 535.—Artificial Insemination: Gathering the Semen

A, Uterus; B, os uteri; C, vagina; D, inseminator; D′, bulb of same; E, rectum; F, bladder; G, the semen.

In the case of old and valuable stallions, artificial insemination may be made to reduce their work by one half, or even more, while at the same time it preserves their productiveness and prolongs their lives and usefulness at the stud.

By the same means, young fashionable stallions may be protected during the period of growth against venereal excess, which in so many instances is allowed to sap the constitution and weaken not only the individual but his offspring.

The overstrain which the rush to fashionable horses inflicts upon them is responsible for much of the premature mortality and impotence from

which many of them suffer, and to this is attached an immense annual loss to farmers and breeders.

Artificial insemination requires that the operator be provided with a suitable instrument to gather up and transfer the semen to the uterus of the mare, and that certain precautionary measures against failure be observed. In this latter connection it is necessary: (1) that the temperature of the syringe employed be raised to 100° F., which may be done by

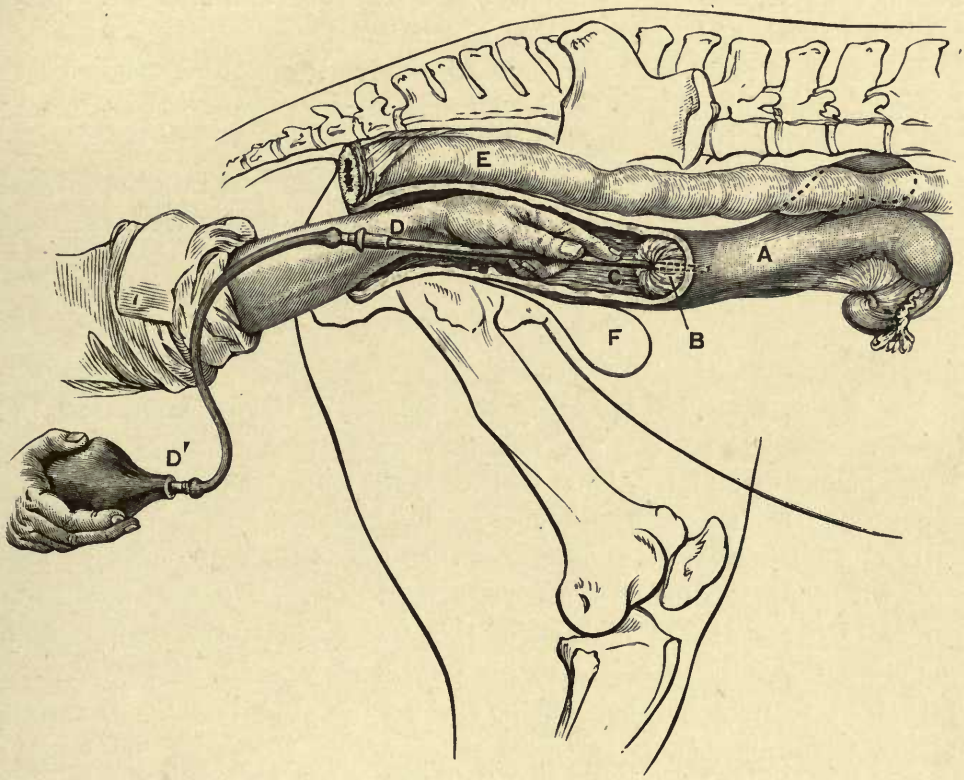


Fig. 536.—Artificial Insemination: Passing the Inseminator into the Uterus

A, Uterus; B, os uteri; C, vagina; D, inseminator; D′, bulb of inseminator; E, rectum; F, bladder.

placing it in a pail of warm water; (2) that it should be thoroughly clean; (3) that the semen should be injected into the uterus of the mare soon after it leaves the sire. Exposure to the air, to cold, or strong sunlight, weakens the vitality of the spermatozoa, and when unduly prolonged kills them and defeats the operation.

The mare to be inseminated must, of course, be "in use", and while in this condition should be served by the horse in the usual way.[1] The seminal fluid discharged during the service will be deposited on the floor of the vagina near to the mouth of the uterus.

[1] Under favourable conditions successful impregnation has followed when the semen has been transported long distances.

When the horse has left the mare, the warm syringe should be introduced into the passage and carried forward by the left hand to the part indicated in the illustration (fig. 535), while the india-rubber ball is being compressed by the right one.

The point of the instrument should then be directed into the seminal fluid (G, fig. 535), and the pressure removed from the india-rubber ball, and as a result the fluid will stream into the syringe. The syringe having become charged, the nozzle is introduced into the uterus (fig. 536), the ball is squeezed, and the operation is completed.

Where it is intended to inseminate a second or a third mare, a fresh charge of semen should be obtained from the same service in the manner described, and the operation repeated.

A supply of seminal fluid may sometimes be caught in a cup directly from the male as he leaves the mare, or some of the service discharged by the mare may be secured in the same way.

SIRES

Nothing is more important to the success of the breeding-stud than a good sire, and to prolong and maintain his fertility can only be effected by scrupulous care and rational treatment, in which the aim should be to keep up the balance of health and render his sexual work fruitful.

It must, however, be remembered that the fertility or power to beget stock will differ in different animals, and in the same animal at different periods of life. The recognition of this fact suggests the desirability of regulating the work of a sire to his powers of service and reproduction, so that abuse may be avoided, his use at the stud prolonged, and the number and value of his produce enhanced.

Rightly or wrongly it is the common practice to allow a horse to commence his stud career at two years old, and, although no apparent ill consequences may follow when sexual work is judiciously apportioned, we cannot help thinking that at this critical period of growth some benefit would be derived by allowing another year to pass over, before calling upon him to exercise his reproductive function.

This precaution is especially needed where condition and growth are backward, or where the latter is in excess of what it should be at that age, when in consequence the system is wanting in strength and vigour. Big colts should be allowed ample time to develop before being put to the stud, and little ones to grow.

When it is decided to use a two-year-old colt, the natural question arises as to how many mares he should be allowed to have. "The number

of mares sometimes allowed to horses at this age is almost incredible, and the view seems to find favour with many that what a colt can do should be the measure of what he should do, and it is no rare occurrence for forty, fifty, or even sixty mares to receive service from these baby sires during their first season. That they may be fairly fruitful under such a strain there are examples to show; but the general result of such a practice is not only to check growth and physical development, but to lay the foundation for sexual weakness and disappointment in the following season, and, it may be, to produce an abiding weakness of the reproductive function, or even permanent incapacity to get stock. Moreover, the offspring of horses so overtaxed are at the best but doubtful blessings to the breeder, and many a farmer can tell how his money and the stud services of a good mare have been thrown away by the incautious use of those overworked youngsters. . . . Having regard to health interests, to quality of produce, and endurance at the stud, a horse at the age in question should not be allowed more than ten to fifteen mares, and it would be much to his advantage, as it would to that of all young sires, if the season were allowed to get well advanced before commencing service. At this time, grass will be plentiful and good, mares will 'come keen' to the horse, the chance of returning will be materially diminished, and the horse's services correspondingly lightened. As to older stallions, the same want of care obtains with them as with the more juvenile section, and many a good horse is prematurely used up or falls a victim to disease as the outcome of unbridled abuse. The number of mares a horse should receive from three years old upwards allows of no fixed rule being laid down. Very much will depend upon growth and development, and even more on natural vigour of constitution and sexual capacity, which latter can only be known by experience. Some horses almost complete their upward growth at two years old, while others at that age have made but little progress."

In settling the work of young sires, every consideration should be given to their fitness in respect of the points referred to above, and lack in one respect or the other should be deemed sufficient to withhold them from stud service until, by time and good living, they have acquired the necessary growth and vigour of constitution to enable them to exercise the reproductive function without prejudice to their full development and maturation as sires.

There is a very wide difference in the desire and the capacity of horses for stud work. Some, although young and fairly fruitful, display a vexatious indifference towards their mares, and can only be induced to consummate the act by the greatest care, or some special device on the

part of the groom. Many of these horses become more and still more indisposed for sexual connection, and ultimately refuse service altogether and become prematurely impotent. In some the desire may be maintained by good living, plenty of walking exercise, iron tonics, and by keeping the horse away from mares for such a period as will bring back the sexual impulse. How long this may be, the attendant must find out for himself, and, having done so, exercise his discretion in directing the services of the horses under his care. On the other hand, there are stallions which with a remarkable capacity for service unite an extraordinary fertility and endurance. A notable instance of this was afforded by a well-known Shire stallion, which, on completing a heavy season in Lancashire, was let for further work in the south. On reaching his destination, at three o'clock in the day, twenty-three mares were waiting for service. Of these, nineteen were found to be in season, and were served the same day, and thirteen proved to be in foal.

"Many sires, and some of great celebrity, have been known to serve from 200 to 260 mares in one season, and to leave a fair proportion of foals." Of course, it cannot be expected that such an amount of sexual work as is here implied can be continued for any number of years without inducing sterility or premature impotence, and owners of stallions, in their own interest, no less than that of their stock, should guard against dangerous abuse of their stock-horses by judicious restriction of their services at the stud.

It is impossible to lay down any hard-and-fast rule by which the work of horses at different ages should be governed, but the following scale may be accepted as a fair average allowance for the season:—

Age.	Number of Mares.
2 years old	10 to 15
3 „ „	25 „ 30
4 „ „	45 „ 60
5 „ „ and upwards	70 „ 100

Condition in the Sire.—How far failure on the part of mares to prove fruitful is due to impotence on the part of sires it would perhaps be difficult to say, but those who are in and about our breeding-studs know that in some circumstances barrenness is largely attributable to this cause. It is too much the fashion to regard the mare as the ever-erring partner, and to overlook the disability of the horse to render his services fruitful; but how often is it observed that numbers of mares both old and young which have been regular breeders fail in a particular season to a particular horse to bear foals; and it is no uncommon occurrence to hear a breeder remark of a certain sire that "he has not left two foals

in the parish", or a comparatively trifling number in a district, notwithstanding that he was well supplied with mares the previous season. This is an occurrence so common as to be within the knowledge of everyone concerned with horse-breeding or stud-management.

Explanations of various kinds are always forthcoming to account for these stud failures, some implicating the mares and others the season, but the shrewd breeder, while allowing for the possible adverse influence of both these causes, does not fail to recognize that other and more potent factor, the sire.

How much of this failure is due to impotence on his part cannot be precisely stated, but there can be no doubt that under the circumstances presently to be referred to it is the predominating quantity. When we consider the exhausting services which stud-horses have to render during the season, and the indifferent preparation many of them undergo in anticipation of the work before them, it is not surprising that they sometimes fail to give the results expected of them.

Without condition, the services of a sire are no more capable of yielding a full measure of success than are those of a race-horse, and to call upon him to perform a season's work in its absence is as much an injustice to the horse in body and reputation as it is to those who use him.

The practice of turning a horse away into a loose-box after the season is over, to spend the winter in confinement, and too frequently on indifferent fare, is, even in these enlightened days, of common occurrence, and not unfrequently the foundation on which subsequent failure of the stud is laid.

When to this is added that bullock-like obesity into which he is rapidly brought during a few weeks of forcing treatment in the spring, little then remains to be done to defeat the object for which he is intended. It is not suggested that fat horses are necessarily impotent, but that they fail to meet the full and legitimate requirements of those who use them, and pay for a fruitful service. In saying so, we recognize the fact that, in order to command liberal patronage, sires, and especially those of the heavy breeds, must be brought up to the show standard, and at a time too when they should be in "racing trim".

In this connection it must be admitted that the users are not altogether free from blame for the losses which they suffer, and until they can judge "make and shape", and select their sires in the absence of soft superfluous flesh and fat, owners of stallions will continue the abuse to which we have referred.

Want of condition not only renders reproduction uncertain, but lays the individual open to attack from all sorts of diseases and accidents of a crippling nature, and to none more than that bane of stallions—laminitis.

Eighty per cent of the cases of this disease occur at the beginning of the season, when every organ of the body is over-burdened with fat, and the muscles devoid of that healthy tone by which the feet are relieved from undue impact of superimposed weight.

When a horse commences his season fat and wanting condition, his stud work is greatly multiplied by mares returning to service, and especially if—as is mostly the case—he is allowed to serve an unreasonable number. In this state his early services are often abortive, and require to be repeated again and again, so that the vigour and condition with which he should have started is never attained. Young and old horses especially are made to suffer, both in body and reputation, by neglect of this first principle of stud-management.

Stallions which have passed through an average season show the effects of its weakening influence, and need at that time as much as any a liberal measure of support. To uphold condition is the end to be aimed at, if a high state of fertility is to be maintained and services prolonged.

In order that this may be done, the winter keep should be generous and of the best. A paddock with ample range, if possible, should be provided, in which exercise and plenty of it may be obtained. Stallions are better in the open, even in the cold days of winter, than in the average stable. It is no uncommon thing to see Mr. James Forshaw's valuable Shire stallions out with their blinkers on at Christmas, when snow is over their hoofs, and most people will respect his large experience of stud-management.

As February comes round, the food ration should be increased, and exercise, commencing with six and increasing to ten miles a day, should be enforced. Hard condition and a fruitful season will be the result, to say nothing of the escape from diseases incidental to obesity.

With judicious management, horses "on the road" will uphold their condition as the season goes on, and far exceed in fruitfulness those that "stand" at home. How much the vitality and strength of the offspring depend upon the vigour of the sire at the time of service is an unknown quantity, but no one acquainted with the subject will fail to realize the importance of their physiological relations. It is distinctly to the advantage of stud-horses that they be regularly fed, and ample time be allowed for digestion to advance, before going to service. Neglect of this precaution is accountable for many of those attacks of indigestion, twisted bowels, and ruptured stomach from which stallions so frequently suffer. Nor is it less important that, as far as practicable, horses on the road should do their work in the early morning and cool of the evening, so that the depressing effects of mid-day heat may be avoided.

TELEGONY

From time to time it has been said by breeders of horses and other animals that females, having bred to certain sires, have subsequently thrown offspring to other sires which in outward form, colour, &c., have taken after the sire to which they had first been pregnant, or in other words, that the influence of the first male is sometimes shown in the produce when the mare is put to a different mate. To illustrate the proposition—a mare having bred to a donkey, her subsequent produce to a horse should present some of the characters of the donkey. In explanation it is suggested that the unripe eggs in the ovary of the mare at the time of the first impregnation, as well as the one which is fertilized, are infected with the germinal matter of the first sire, and rendered capable of producing foals to other horses more or less like him; or, as Bruce Lorre puts it, "the dam absorbs some of the nature or actual circulation of the yet unborn foal, until she eventually becomes 'saturated' with the sire's nature or blood as the case may be".

What has hitherto been regarded as the most authentic and convincing experiment in this connection was performed by Lord Morton in the early part of the nineteenth century. He put a chestnut mare, which had never before bred, to a quagga stallion, and as a result obtained a female hybrid of a dun colour which "in her form and colour bore very decided indications of her mixed origin". The same mare subsequently passed into the hands of Sir George Ouseley, who put her to a black Arabian horse two consecutive years, and produced a filly and a colt respectively which in their colour and in the hair of their manes, it is said, bore a striking resemblance to the quagga. Both were bay, and distinguished by a "dark line along the ridge of the back, the dark stripes across the forehead, and the dark bars across the back part of the legs. The stripes of the colt were confined to the withers and to the part of the neck next to them. Those on the filly covered nearly the whole of the neck and the back as far as the flanks. The colour of her coat on the neck adjoining to the mane was pale and approaching to dun, rendering the stripes there more conspicuous than those on the colt. The same pale tint appeared in a less degree on the rump, and in this circumstance of the dun tint also she resembled the quagga. . . . Their manes were black, that of the filly short, stiff, and stood upright, and that of the colt long, but so stiff as to arch upwards and to hang clear of the sides of the neck, in which circumstance it resembled that of the hybrid."

Prima facie this would appear to admit of the conclusion that impreg-

nation by the quagga had in some way or other imbued the system of the mare from which these two foals were bred, with the power to impress upon her subsequent offspring by other sires the characters which distinguished her first mate, the quagga.

However inviting such a conclusion may be, the fact, as mentioned by Darwin, must not be overlooked that "in all parts of the world, stripes of a dark colour frequently appear along the spine, across the legs, and on the shoulders occasionally, where they are double or treble, and even sometimes on the face and body, of all breeds of horses and of all colours". Notwithstanding this, Darwin was satisfied that in the case of Lord Morton's experiment "the quagga had affected the character of the offspring subsequently got by the black Arabian horse".

The evidence which that distinguished observer, Mr. Herbert Spencer, was able to procure, satisfied him of the truth of the influence of the male on the progeny subsequently borne by the mother to other males, and he suggests that this remarkable phenomenon is the result of the ova in the ovaries becoming infected with germ-plasm through her tissues.

From experiment and other sources of information, Mr. Romanes was equally satisfied that a previous sire "asserted his influence in a subsequent progeny", but he was of the opinion that instances of the kind were of rare occurrence.

Mr. Allison, who writes for the *Sportsman* under the *nom de plume* of the "Special Commissioner", avers that it would "not be difficult to furnish hundreds or even thousands of instances" of the occurrence. Whether the cases referred to by Mr. Allison would bear that searching method of enquiry which science demands before deciding upon so delicate and obscure a question, there is no evidence to show. Some breeders of horses, dogs, and other animals claim to have experienced the effects of telegony in their studs and kennels, but it is doubtful if their knowledge of the possible influence of reversion and other cognate subjects was sufficiently extensive to permit of their forming a reliable judgment.

In this connection Professor Ewart points out that while many English breeders have been it may be over-credulous, not a few German breeders have long looked with suspicion on the infection theory. "Professor Kuhn (late head of the Prussian Agricultural station at Halle), Settegast, Nathusius, and others familiar with scientific methods, notwithstanding an extensive experience in breeding and crossing, have never known a case of telegony. Hence it would appear that while some doubt its ever occurring, others are convinced there is no such thing as telegony, that the female is neither infected by the first male, nor by subsequent mates to which she bears offspring."

Professor Ewart, who has made the subject of telegony a special study for several years, employing in his experiments Burchell's male zebra, which he has crossed with several varieties of the horse, and subsequently mated the mares so used with horses, believes in regard to markings that "if those on Sir George Ouseley's colts were not due to the dam having been influenced in some way by the quagga, they resulted from reversion". "I prefer", he says, "the reversion explanation, because it seems to be simpler and more in accordance with established facts." On the general question, however, he is careful to note that "it would be premature to come to any conclusion as to whether there is such a thing as infection of the germ or not".

Millais, who made numerous experiments with "pure-bred dams and wild sires, and returned them afterwards to pure sires of their own breeds, never saw a case of telegony", and "every single experimenter", he says, "who has bred to produce the phenomenon has hopelessly failed like himself".

We have endeavoured to elicit the general experience of horse-breeders and stud-managers by submitting to them the following question on the subject, and it will be seen by the answers given below how little is known of it, and how universally the theory is repudiated by them.

Question.—When a filly has been put to a horse and bred a foal by him, it is said by some that foals from the same mare subsequently born to other sires partake after the first sire. Have you any experience which bears out this statement? If so, will you kindly give me particulars of the case or cases?

1. "It is a subject in which I have taken great interest for some years. In the cases that have come under my observation I have never had an instance of foals born from the same mare taking after the first sire."—*Rev. D. B. Montefiore, Mursley Hall, Winslow.*

2. "I think the first sire influences the produce when a mare is put to another sire, but have no experience to offer. Mowthorpe, my stud-groom, is certain they do, but neither can he give any evidence on the point."—*R. Whitworth, Southwood End, Halifax.*

3. "I have not had any cases where a mare has bred a foal and then, when put to a different sire, has bred stock which has taken after the first sire. I once had a case where I could not get a Shire mare to commence breeding to a Shire horse, so we used a hackney, which was successful. Several people told me she would always breed hackneys or very light foals, but I proved this to be quite the contrary, as the next foal she had, which was by a Shire horse, was very weighty and full of bone and made a good horse, and the mare continued breeding good Shires."—*J. Wainwright, Hargate Hall, Buxton.*

4. "I have not noticed a sire to have any effect on the future progeny of a mare by other sires, and I don't think it possible."—*C. E. E. Cooke, Bygrave House, Baldock, Herts.*

5. "I have not in my experience noticed that when a filly is put to a horse and bred a foal by him, foals from the same mare subsequently born to other sires partake after the first one."—*W. Crosland, Buscot Park, Faringdon.*

6. "I do not know that I have ever known the taint from the first sire to descend in a following year to the progeny, either in horses or cows."—*J. P. Cross, Catthorpe Towers, Rugby.*

7. "So far as my experience goes, I have not noticed that foals got by different sires from the same mare have partaken after the first horse. I have heard it said that if a nag-mare was first discovered by a cart-horse and afterwards mated with the lighter class of stallions the foals would for two or three years have a strain of the cart-horse blood in them, but I have never known it."—*A. Collen, Hackney Stud, Saffron-Walden.*

8. "I have heard that when a filly has been put to a horse and bred a foal by him, foals from the same mare subsequently born to other sires have partaken after the first sire, but in my experience I have never observed anything of the kind."—*J. Bastin, Norbury Park Farm, Dorking.*

9. "I have never known a case in which a sire had any influence on the subsequent produce of a mare by other sires.

"I know many people hold very strong views in regard to this matter, but I feel quite confident that their theory is founded on a mistaken idea.

"How often do you find a smallish, undersized, insignificant-looking mare that is reputed to be and instanced in her neighbourhood as a good and consistent breeder, and you will hear the remark, she always breeds one better than herself, and this not always to the same horse, but to any decent well-bred horse she may be put to. To account for this you examine her pedigree, and you find it made up for several generations of weighty, typical Shire animals that have themselves been bred true to type. This mare generally breeds animals that have a strong family resemblance to each other, very dissimilar to herself, and perhaps not much like the sire, but breeding always one type to different horses. Thoughtless people are apt to say that the foals must take after the first sire, though they may have none of his peculiarities really, and the people who make the assertion probably never saw the sire."—*J. Green, Galwich Estate Office, Ashbourne.*

10. "I have had no experience to justify me in coming to the conclusion that a filly, breeding for the first time to a certain horse, and then

mated with other horses and breeding from them, will produce foals partaking of the conformation or type of the first sire."—*John James, Dinarth Hall, Colwyn Bay.*

11. "I have crossed scores of mares of coach, cart, hackney, and thoroughbred varieties, and have never yet been able to find in my experience that it made the slightest difference in regard to the subsequent produce."—*Mansfield Harrison, Brookfield Stud, Highgate.*

12. "I believe in some cases the effect of previous mating is visible in the produce, but personally I have not come across a case in the horse. On one occasion we had a Clydesdale mare accidentally served by a Shetland pony. The produce was a nondescript animal, just what you would have expected from such a violent cross. Her next foal was to a pure Clydesdale, and it did not show the slightest trace of the Shetland with which she had previously been mated, though I fully expected it would have done so."—*R. Brydon, Seaham Harbour Stud.*

13. "My experience is quite contrary to the idea that the first sire has any influence on the subsequent produce of mares by other sires."—*J. Paisley, Waresley Estate Office, Sandy.*

14. "The point you raise with regard to breeding of horses, that foals partake after the first sire, is, I think, a common belief. I have, however, had considerable experience in breeding, and I have never as yet been able to satisfy myself that such is the case."—*J. Lett, Rillington, Yorks.*

15. "I really cannot say that I have ever noticed that when a mare has been put to a horse and bred a foal by him, foals from the same mare subsequently born to other sires have partaken after the first sire."—*E. Green, The Moors, Welshpool.*

16. "I believe that when a mare is served by a good horse, her subsequent progeny to other sires will be favourably influenced by the first. I have not had a case myself."—*F. Buttle, Kirkburn Manor, Driffield.*

17. "Having studied the question of a sire's influence on stock other than his own for now forty years, I am convinced that there is no ground whatever for saying that he has any influence on the future progeny of the mare when put to other horses."—*J. Forshaw, Carlton-on-Trent, Newark.*

18. "I certainly do not think that when a mare has been put to a horse and bred a foal by him, foals from the same mare subsequently born to other sires will partake after the first sire."—*John Rowell, Bury, Huntingdon.*

19. "I have heard a good deal said about the matter you mention, but I do not think there is so much in it as many people seem to think—in fact, if there is anything at all. I give you one or two cases of my experience.

"1st. 24648 'Royal Duchess', grey, was served as a two-year-old by 'Dunsmore Combination', which is a dark-brown, and she produced a grey foal which was rather of the Clydesdale type. As a three-year-old she was served by 'Dunsmore Bismarck', a brown horse, and produced another grey, which also took after that sire in character of legs and hair, which was rather inclined to be curly. The following year she was served by 'Dunsmore Jameson', which is a bay. She then produced a bay-brown of a class resembling most of that horse's get, and not the least bit resembling either of the other two horses she had been served by, the colt having more size and scale than any of the others. She was again served by 'Dunsmore Jameson', and produced another bay-brown colt, which died when it was about six weeks old. She is now suckling a grey by the same horse, which is at present not so strong as the two she bred previously by him."—*T. Ewart, Dunsmore Home Farm, Rugby.*

20. "In my experience I have never known a sire when put to a mare to influence foals from her by other sires."—*Alfred S. Day, Berkeley Stud, Crewe.*

21. "I have no experience of violent crosses, but where animals of the same breed are used, I do not think there is anything in the matter suggested by your question."—*E. Drewry, Holker, Cark-in-Cartmel, Lancashire.*

22. "I have keenly watched the subject for years, but have never seen anything to indicate that the first sire influenced in any way the produce of other sires from the same mare."—*W. Bower, East Rudham, Norfolk.*

23. "I have no experience of a case of a mare producing a foal that favoured a previous sire."—*T. B. Barling, M.R.C.V.S., Amberley Court, Monmouth.*

24. "My experience has been that a foal from a mare by a different horse to which the same mare has previously bred, does not partake after the first sire in shape or colour.

"To give one of many examples, the hackney mare 'Bonny Clara' 6419 bred to the chestnut horse 'Clovelly' a chestnut filly foal. The same mare put to 'Derwent' 4737, brown, produced a brown filly; the next foal, by 'County Member' 948, brown, a bay filly.

"Her next three foals are all by 'Royal Danegelt' 5785, chestnut, and are all chestnuts. These several foals varied in shape and colour according to their different sires."—*H. Starling, The Paddocks, Elsenham, Essex.*

25. "I have had a number of mares here with foals by trotters (American), Shire horses, thoroughbreds, all of which have afterwards bred to my hackney stallion, and in no case has any trace of a previous impression been found in their immediate or subsequent foals. I am there-

fore unable to believe in the subject of telegony."—*A. W. Hickling, Aldbolton, Nottingham.*

26. "I know it is the theory of some people that a mare will throw back to the first horse that she breeds by, but in my experience I have never found it so."—*William Flanders, Witchford, Ely.*

27. "I cannot say positively that any actual impression from the service of a stallion of a different breed or type was conveyed to the next produce of another horse."—*J. Conchar, Wylde Green, Birmingham.*

28. "I am not aware that we have had any case where a horse has affected a mare's progeny for more than one foal."—*Colin Campbell, Danesfield. Marlow.*

GENERATION

The one prominent function of the generative system is the perpetuation of the race, and using the term in its widest sense, generation includes all the processes which result in the multiplication of living beings.

Reference to the description of the organs which constitute the generative system in the higher animals—the mammals, for example—will show that two sets of complicated structure belonging to two sexes—male and female—are concerned in the function, and a knowledge of the functions of the two distinct sets of organs will leave no room for doubt that the female has the largest share in the perpetuation of the species. "*Omne vivum ex ovo*" is a very familiar quotation, but it contains a most important truth. The ovum of the female animal or plant contains all the material necessary for the formation of a new animal or plant. In the ovum or egg there is a germ possessing a dormant vitality, which only awaits contact with the sperm-cell of the male to become actively alive and capable of appropriating the material by which it is surrounded, and evolving from inert and shapeless substances all the tissues and organs which constitute the new existence.

With the impregnation of the germ-cell by the action of the male, the more complicated function of the female begins, and must go on until the new creature is sufficiently advanced to live an independent existence. A merely superficial analysis of the function thus lightly sketched, reveals the three essentials of which it consists, namely, impregnation, gestation, and parturition, each of which includes certain conditions which vary in different beings.

IMPREGNATION

Impregnation is effected by the contact of the sperm-cell of the male with the germ-cell of the female. The precise manner of the contact, and the means employed to ensure it, are of no consequence to the result. In the most highly organized mammals, for instance, the fluid secreted by the testicles of the male (semen), with fluid from the prostate and other glands, is conveyed to the generative organs of the female by means of the intromittent organ, which injects it forcibly into the vagina, and to some extent also through the open mouth of the uterus into that organ. Sperm-cells, or, as they may more correctly be termed, spermatozoa, which have been set free from the sperm-cells, are abundant in the fluid so injected. These actively moving bodies are the essential agents in impregnation, and whether they reach the germ-cells of the ovum in the natural way, or are conveyed artificially by instrumental means, as in artificial insemination, the effect of their contact is the same. The previously passive germ-cell becomes active under the action of the stimulus imparted by the sperm-cell, which rouses the developmental force, before lying dormant, in the germinal vesicle of the ovum.

Another important factor in the generative function—the receptive condition of the ovum—is at this stage to be considered. Not every contact between the sperm and the germ is fruitful; possibly the power of the sperm-cell may always be active, but it is quite certain that the ova in the ovarium are not at all times ready to react to the mysterious force which the sperm-cell is ready to transmit.

During the period of life which includes the power of procreation, development of ova is always going on in the substance of the ovary. From a mere speck of germinal matter or protoplasm, the egg originates as a simple cell, gradually attaining to the condition of the mature ovum with its external vitelline membrane (*zona pellucida*), the yolk-sac containing the yolk and a germinal vesicle with the central germinal spot. As the development of the ovum reaches nearer to the point of perfection, the Graafian follicle in which it is contained and protected, advances to the surface of the ovarium, blood circulation in the external membranes increases in volume and rapidity, and soon the surface of the Graafian follicle is covered with an arboresque arrangement of brightly coloured vessels. In due time the follicle bursts and sets the mature ovum free to pass into the open fimbriated mouth of the Fallopian tube, through which it passes to the interior of the uterus. If no contact takes place with the sperm-cell, the ovum, although ready to receive the stimulus, which, however, may not be

present, passes into the uterus and forms part of the waste products of the mucous membrane, and with them is expelled; one of the many instances of the reckless liberality of the natural functions, which are constantly supplying redundant matter for the development of new organs or repair of wasted tissue—matter which is often in excess of the demand, or is supplied unconsciously when the conditions are not favourable to its fruitful use.

THE OVUM

Changes which occur in the mammalian ovum during its progress to maturity are always going on, from the time of puberty to the end of the productive life of the animal. Its mature state is reached with the occurrence of æstrum, or heat, and it is to be noticed that during the few days of continuance of this condition there is a marked increase of sexual excitement. The mature ovum or ova are at this time discharged from the Graafian follicle.

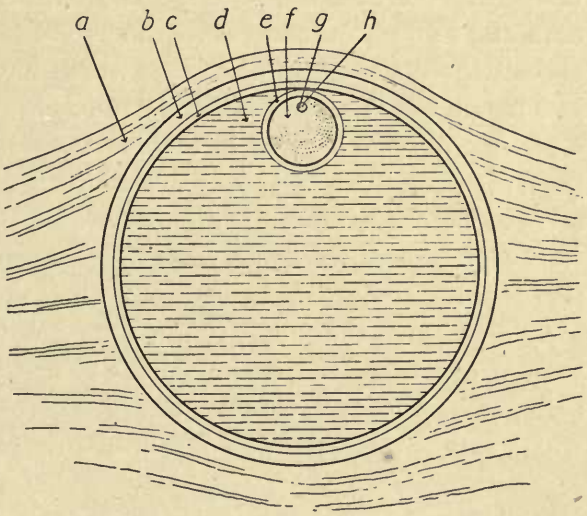


Fig. 537.—The Ovum lying in the Graafian Vesicle

a, Stroma or tissue of ovary; *b*, *c*, external and internal tunics of Graafian vesicle; *d*, cavity of vesicle; *e*, thick tissue of ovum or yolk sac; *f*, yolk; *g*, seminal vesicle; *h*, the spot.

An idea of the form and structure of the mammalian ovum may be gained from an examination of the egg of a bird. The common fowl furnishes the most simple examples, simple because they are prominent objects, easily seen by the unaided eye, while the mammalian ovum is a microscopic object, only to be distinguished by the aid of a highly magnifying power.

In the above illustration (fig. 537) a diagram, with description, exhibits the ovum lying in the Graafian vesicle.

Physiologists are not agreed as to the successive steps in the formation of the ovum, but it is allowed that the development of the germinal vesicle is precedent to the appearance of the yolk. The germinal spot is to be seen in the germinal vesicle, and presumably the spot is the incipient body round which the vesicle is developed.

From its origin to its maturation the chief changes which occur in the ovum are those incidental to its growth, and the necessary advance of the

body from the centre of the Graafian vesicle to its circumference. The germinal vesicle itself, as maturity in the ovum advances, becomes relatively smaller, owing to the more rapid growth of the structures with which it is associated.

While the ovum is advancing to the circumference of the Graafian vesicle, the granular contents of that vesicle are pushed to the inner side of the investing membrane which forms its wall, and become the *membrana granulosa*, in which the ovum itself is embedded.

According to modern views, the germinal vesicle, during the growth of the structures of the ovum, undergoes changes which result in its temporary obliteration, and the substitution of a spindle-shaped body at each end of which the elements of the yolk are clustered.

All the developmental actions which have been referred to as occurring in a single ovum, it will be understood, are going on at the same time in a number of ova enclosed in the ovaries. In fact, it is not unreasonable to presume that, from early life, ova are constantly being developed and discharged as effete matter, falling short of the indefinable something which would give them the right to take rank among the actual, or, at the least, possible, entities.

To continue the story, it must be granted that one or more of several mature ova meet the sperm-cells, which can start their dormant life into activity, and in such case on the instant of contact commence the changes which end in the formation of a miniature representation of the parent.

CHANGES IN THE OVUM AFTER IMPREGNATION

At what stage of its progress from the ovarium through the Fallopian tubes to the cavity of the uterus the ovum meets the sperm-cell from the seminal fluid is not known. Most probably the point of contact is purely accidental. The spermatozoa are capable of rapid movements, and may meet the advancing ovum at any point of its course, even from the moment of its exit from the Graafian cell. Wherever the contact between the germ-cell and the sperm-cell occurs, the resulting changes are wonderful and also inexplicable.

First it is evident that active developmental powers exert themselves, and effect in the contents of the ovum remarkable structural changes. Next it may be predicated that the male spermatic fluid imparts certain qualities and characters to the germ, such as form, constitution, and disposition, which belong to the male, as it later becomes evident that the female parent also shares the power of transmitting these qualities in varying proportion.

Theoretically, it may be considered that the male transmits form, and the female disposition and character, and in man the intellectual power. To this rule there are, however, many very marked exceptions.

After the disappearance of the germinal vesicle, curious changes in the yolk are perceived, resulting in segmentation. First, depressions or notches are noticed in the membrane surrounding the yolk at two points, and these slowly advance through the mass, cutting it in halves, while almost at the same time a similar process is going on in each half, making four divisions, which are divided again and again, until a mulberry mass is formed. This process of multiplication by division of the mass possesses a remarkable significance, which will be referred to in connection with the process of generation in the lower forms of life (fig. 538).

Completion of the process of segmentation leaves the yolk a mass of delicate granular spherical masses, each with a clear centre. Conversion of these masses into cells is effected by the development of an investing membrane round each mass. As soon as the cell-formation is perfected, the peripheral cells arrange themselves on the surface of the yolk, the central masses follow, and finally complete the construction of a thick membrane, which is known as the germinal or *blastodermic* membrane, which soon divides into two layers; the upper one nearest to the original investure of the yolk, the vitelline membrane, is called the serous layer of the blastodermic membrane, and the lower one the mucous layer. From the upper or serous layer, the outer portions of the animal body, the bones, muscles, and skin, are developed, while the inner or mucous layer, which is in contact with the yolk, forms the internal organs or viscera.

THE DEVELOPMENT OF THE EMBRYO

First Signs.—At the outset, the attempt to describe the formation of the various parts of the young animal is met by an insuperable difficulty, because by no form of verbal gymnastics is it possible to describe a whole set of simultaneous processes by the aid of consecutive phrases. It is easy, for example, to state the fact that in the germinal membrane the embryo is formed; that bones, muscles, integument, and viscera appear, and that adaptive changes go on in the uterus, in which the young one has to pass its embryonic and fœtal life; but unless the reader will consent to make a mental effort to realize that the changes are all going on in different degrees at the same time, there is no hope that the writer will succeed in conveying a correct idea of the true nature of the developmental process.

Proceeding from the point which has just been reached, the formation of a germinal membrane by an accumulation of cells round the inside of the

investing membrane of the yolk (yolk-sac), it will be quite easy to understand that at a certain part in the blastodermic membrane a round mass of cells appears, called for the sake of distinction the germinal area. In this round mass, which soon becomes an oval mass, the first sign of the embryo is seen, as shown in the accompanying figure (fig. 538, *e*).

On each side the primitive groove or trace above described, are collected two oval masses of cells rising above the plane of the germinal membrane and bending towards each other until they touch and form an arch in which the incipient spinal cord is to be lodged; all this is arranged, it must be observed, in the upper or serous layer of the germinal membrane. Immediately below the primitive groove a line of cells may be recognized, forming the *chorda dorsalis*, the rudimentary stage of the bodies of the bones of the back (dorsal vertebræ). Then below the primitive groove, at the same

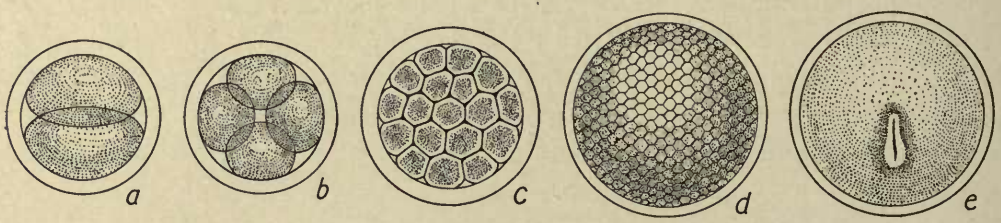


Fig. 538.—The Development of the Ovum

a, First division of the ovum; *b*, *c*, *d*, subdivision of the ovum; *e*, first trace of the embryo.

time that the cells of the laminæ dorsalis are closing over to form the central canal for the spinal cord, the serous membrane sends off prolongations from its lower margin, the *laminæ ventrales*, which unite to form the walls of the trunk to enclose the abdominal viscera.

As they proceed downwards, the *ventral laminæ* turn inwards, enclosing part of the yolk-sac, after which the yolk and inner mucous layer of the germinal membrane are divided into two portions, one being retained in the body of the embryo, the other being left outside. The latter is called the umbilical vesicle. The mucous layer of the germinal membrane now lines the interior of the abdominal cavity and also the interior of the umbilical vesicle. The upper or serous layer is continued round both, and from the portion of the mucous layer enclosed in the body of the embryo the intestinal canal is developed.

This state of the embryo is represented in the next illustration (fig. 539).

Fœtal Membranes.—While the changes above described have been going on, the formation of the fœtal membranes, the allantois and amnion, is proceeding. Folds of the external layer of the blastodermic membrane are raised to enclose the body of the embryo forming the amnion; at the same time during the development of the amnion the allantois protrudes from

the hinder portion of the intestinal canal, as a small pear-shaped mass of cells at first, but, rapidly extending, it presses its way between the folds of the amnion and comes in close contact with the outer one of the two folds, becoming more vascular as it proceeds. Reaching the umbilicus, the allantois is divided into two parts. The outer part, however, extending to the external investure of the ovum, the chorion, shrivels, and is lost; the other portion remains in the abdominal cavity, and part of it is converted into the urinary bladder, while the remaining portion extends from the bladder to the umbilicus under the name of *urachus*, which after birth forms one of the ligaments of the bladder.

It may be remarked here that an oval body flattened in form, which is commonly described as a false tongue, and sometimes affirmed to exist in the mouth of the foal, is really a concretion which is met with in the fluid of the allantoid sac, and nowhere else; occasionally there are several of these bodies, of various sizes. The name given to them, "*Hippomanes*", indicates that they were known to the Greeks, and an ancient superstition attributed to them talismanic power, a belief in which still exists in some parts of the country.

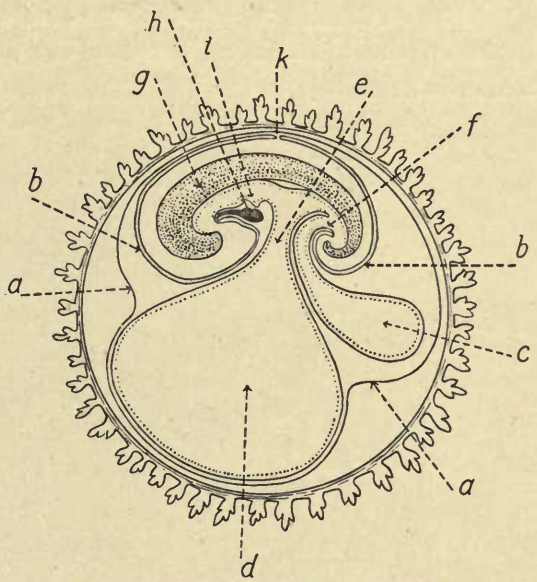


Fig. 539.—Development of the Embryo, eighteenth day

a, Outer or corneous layer; *b*, amnion; *c*, allantois connected with the anal portion of the alimentary canal; *d*, yolk-sac or umbilical vesicle; *e*, vitello-intestinal opening; *f*, simple alimentary canal in lower position; *g*, trunk and head of embryo; *h*, fœtal heart; *i*, alimentary canal in upper portion; *k*, place of convergence of amnion and reflexion of false amnion or corneous layer.

The annexed figure (fig. 539) shows the arrangement of the three membranes which invest the ovum, *i.e.* the external chorion, the amnion, the outer portion of which becomes in part firmly attached to the inside of the chorion, and the allantoid sac.

The villi on the outer surface of the chorion of the human ovum (fig. 540) are seen to be massed on the right side of the figure to form the placenta. In the equine ovum there is no circumscribed placenta, but instead the vascular villi are connected throughout with the internal uterine membrane by means of numerous placental tufts, which penetrate the lining of the uterus so that the capillaries of the fœtal vessels and those of the maternal vessels are in contact over the whole surface. There is, however,

no actual communication between the two sets of capillaries, but the blood-stream of the mother and that of the fœtus are separated only by the thin walls of the vessels, through which the blood is constantly flowing. The interchange which takes place between the maternal and the fœtal blood, for the nutrition of the young animal, necessarily is carried on through the two layers of membrane by osmosis, *i.e.* that force which regulates the interchange of fluids through wet membranes.

Blood-vessels in the embryo commence by formation of a thin membrane in the blastoderm, between the serous and mucous layers, at a part which is described as the vascular area. Red lines appear, and form a net-

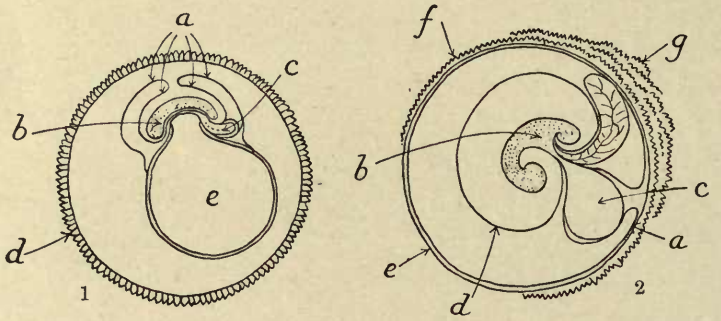


Fig. 540.—Development of the Human Ovum

1. Early stage: *a*, interior and exterior folds of the serous layer joining the amnion; *b*, embryo; *c*, incipient allantois; *d*, chorion; *e*, vitelline mass surrounded by blastodermic vesicle. 2. Second month: *a*, amnion, outer layer, coalescing with chorion; *b*, embryo; *c*, umbilical vesicle; *d*, amnion, inner layer; *e*, smooth portion of chorion; *f*, villous portion of chorion; *g*, elongated villi collecting into placenta.

work of vessels filled with blood, a rudimentary heart is formed in the vascular area, and to that organ the branching vessels proceed, and the outline of the circulatory system is complete; the details being filled in by further developments in correspondence with the continuous advance of the embryonic structures.

In the next illustration (fig. 541) the condition of the embryo and its membrane at the age of seven weeks is shown.

Changes which occur in the Uterus in Gestation.—Further consideration of embryonic growth and development may be deferred for a space, in order to explain the adaptive alterations which have up to this time taken place in the uterus.

At an early period in utero-gestation the openings of the glands of the mucous membrane lining the uterus increase in size and become more numerous. Meanwhile the membrane itself receives additions which render it softer, thicker, and more vascular than the normal membrane; in fact, the added materials constitute a new membrane under the name of the

membrana decidua, which is afterwards divided into three layers—the decidua *vera*, decidua *reflexa*, and decidua *serotina*; the last named is especially devoted to the reception of the villi of the chorion. In the cavity of the uterus a quantity of fluid rich in nucleated cells collects, in contact with the deciduous membrane and the chorion, aiding in the process of nutrition and purification of the fœtal blood.

The membranes which have been described as surrounding the embryo also contain fluid, and the young animal during the whole of its existence

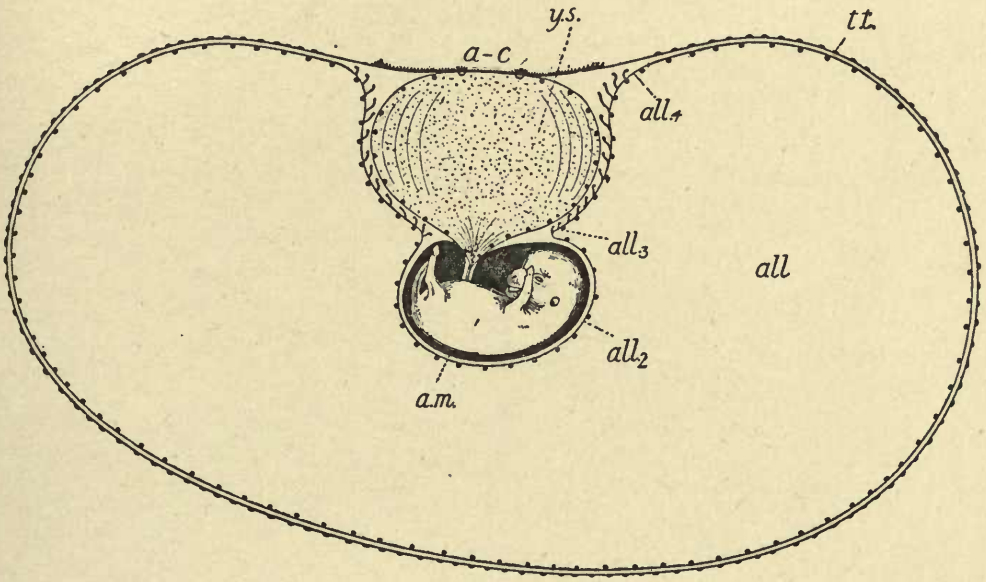


Fig. 541.—Embryo of Horse at Seven Weeks

tt, Embryo sac; *all*, all_2, all_3, all_4, allantois; *am*, amnion; *ys*, yolk sac; *a–c*, absorbing area

in the uterus is surrounded and protected by water cushions of the most perfect construction.

It may be mentioned incidentally that all the membranes belonging to the fœtus, with a large portion of the deciduous linings of the uterus, are cast off at the time of parturition as the *after-birth*, and the uterine mucous membrane gradually returns to its former condition.

Development of the Organs.—Up to this point the object of the writer has been to convey to the reader some idea of the very interesting subject of embryonic development from the mature ovum, which is a mere speck about the $\frac{1}{1000}$th part of an inch in diameter, to the point at which the rudiments of the young animal are formed, and the embryo is in vascular connection with the mother by the contact of the vessels of the chorion surrounding the ovum with those of the lining membrane of the uterus, so arranged that nutriment may be transferred from the parent to the offspring,

and the oxygenation of the blood be effected by the process of osmosis. Thus the placental union may be looked upon as representing an organ of respiration as well as of nutrition.

Growth and development continue from the stage at which the embryo was left at the seventh week to the period when the embryo becomes

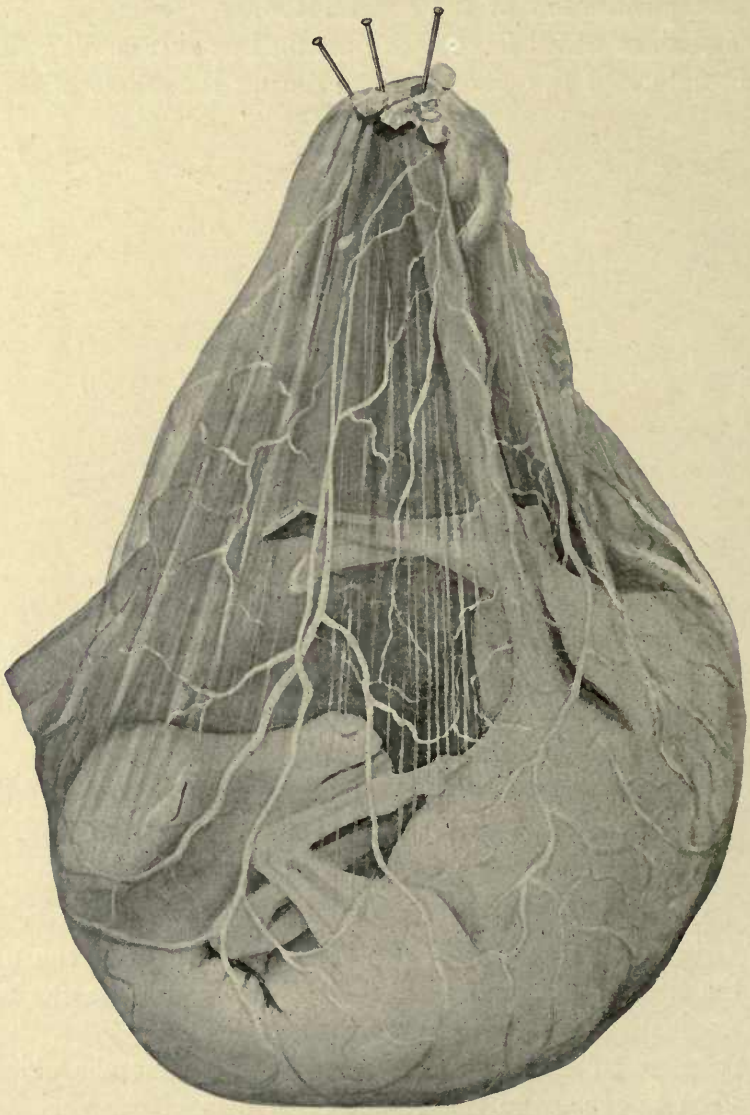


Fig. 542.—Foal about Fourth Month

the fœtus, about the fourth month (fig. 542) all the organs then being miniature representations of those of the animal when separated from the mother by the act of parturition.

A detailed account of every step in the further development of the embryo would occupy more space than can well be allotted to the sub-

ject; it will, therefore, be necessary to condense the description as far as possible.

Development of the Nervous System.—In the early embryo the formation of the line of cells below the primitive trace was described as the *chorda dorsalis*, the basis of the future backbone or vertebral column. Conversion of the gelatinous mass of cells into bone is the simple result of the deposition of bone-earth, calcium phosphate and carbonate mainly. With the ossification is associated the necessary elaboration of form of the bones, ending in the development of the bodies, arches, and processes of the vertebral bones, which are divisible into neck, back, loins, and tail—*i.e.* cervical, dorsal, lumbar, sacral, and coccygeal bones. At the anterior part of the vertebral column a prolongation of the structures occurs, to form the cranium to contain the brain, and next the bones of the face are formed from a series of arches derived from the visceral laminæ, which have been described.

The four limbs or extremities at the same time are growing from the laminæ which form the boundaries of the trunk, and it is noticeable that in all vertebrate animals the four extremities are at first identical in form, whether their ultimate use is to be for walking, grasping, swimming, or flying; in other words, whether the extremities are to be finally feet or hands, or fins or wings, they all have the same shape at first. The highest mammal in the course of embryonic development exhibits some of the features of the reptile, fish, and bird, a good example of evolution in a compressed form never exciting any astonishment, because it is never seen by the ordinary eye, being hidden in the membranes which invest the ovum, and only to be detected by elaborate and minute dissection by a practised anatomist skilled in the use of the most delicate instruments.

Development of the Heart and Vessels.—In its primitive condition the heart is a mass of cells to which, as already described in the embryo, the vessels of the vascular area tend and ultimately reach, forming the rudiments of the circulatory system.

Cavities are constructed in the mass of cells representing the heart, which become separated to form the ventricles and auricles. Blood-vessels which were formerly only red lines acquire size and shape, and divide themselves into arteries and veins, and gradually the complicated mechanism which is described in the section on the anatomy of the organs of circulation is elaborated from a few clusters of cells.

Long before birth the fœtus possesses a perfectly complete set of organs connected with the circulation, differing in a few details of construction to meet the peculiarities of the fœtal environment. To understand the circulation of the blood in the unborn foal, it is desirable to refer to

the description of the circulation of the blood in the adult horse (see p. 436, Vol. I, Anatomy section).

In regard to the fœtal circulation, it will be convenient to commence with the umbilical arteries, two in number, which convey the blood which has already passed over the body of the fœtus to the vascular tufts which constitute the placenta. In the way recently explained, the blood so conveyed effects an exchange of its effete matters through the walls of the fœtal and the maternal capillaries, and receives in return nutriment and oxygen. Thus renovated, the blood is carried back by the converging capillaries, which unite to form the umbilical vein, which vessel with the two umbilical arteries and the urachus mainly constitute the umbilical cord. The blood in the umbilical arteries is really in the fœtus comparable to the venous blood in the mature animal, while the umbilical vein receives the renovated blood, and thus performs the function of an artery.

Passing through the navel (*umbilicus*), the vein enters the liver of the fœtus, and in the horse pours the whole of its blood into the portal vein. In animals other than soliped or single-hoofed, the vein divides before entering the liver, and sends part of its blood directly through a separate branch (the *ductus venosus*) into the posterior vena cava. In the equine fœtus, however, all the blood gets into the vena cava at last, and thence to the right auricle of the heart, which cavity also receives the blood from the anterior part of the body through the anterior vena cava. This blood goes directly through the auricle into the right ventricle, while the blood from the posterior vena cava is directed by the Eustachian valve through an opening (the *foramen ovale*) in the muscular wall which divides the right from the left auricle, and at once passes to the left ventricle, and by the contraction of the walls of that cavity is driven over the body after having met with the blood in the right ventricle, which has passed into the pulmonary artery in the ordinary course, but instead of reaching the lungs has been diverted into the arterial duct (*ductus arteriosus*), which in the fœtus leads directly from the pulmonary artery to the posterior aorta. It is of course understood that the fœtal lungs are not respiratory organs, as no air can reach them; therefore nothing would be gained by the blood entering them in large quantity; in fact, that fluid has been aerated in passing through the placenta. After circulating over the body, the blood is again carried by the pulmonary arteries to the placenta, and the course of the circulation just described is repeated. The total result of the modification in the arrangement of the circulatory apparatus in the fœtus is the distribution of mixed blood over the body; only that

portion which passes through the umbilical arteries reaches the placenta and becomes oxidized and otherwise improved by the interchanges which take place between the maternal and fœtal fluids.

Development of the Organs of Special Sense.—As soon as the structures forming the bony boundaries of the spinal column and cranium are ready for their reception, the spinal cord and the brain are formed, constituting the cerebro-spinal system; the eyes, organs of hearing and taste, are gradually developed by the ordinary processes of cell-formation.

The alimentary canal has already been referred to in connection with the mucous layer of the blastodermic membrane, and it may be observed that from the same source the other organs of the abdominal cavity, and also the organs of respiration, are formed, and the fœtal structures are, so far as general outline is concerned, complete. The subsequent processes are those of growth due to the continually added supplies of nutriment, until the young animal is fit for "separate life", when some mysterious stimulus acts upon the uterus and causes expulsion of the fœtus in the act of parturition.

The Foal.—For some time, however, the foal has to depend on its mother for its subsistence, and as soon as it can rise to the erect position, instinctively it seeks for the teats of the dam, from which for some months to come it will obtain its chief food.

By degrees the foal, prompted by instinct or curiosity, essays the taste of the herbage at its feet, and in time begins to prefer it to the maternal fluid. The mother at the same time seems to realize that her nursing days have been sufficiently prolonged, and gives her colt emphatic hints that it has ceased to be solely dependent on her for its daily food.

EVOLUTION AND GENERATION

The story which has just been told of the function which is expressed in the term "generation" may be considered from more than one point of view.

In the record of the successive changes which end in the production of the young mammal resembling its parents in form, constitution, temperament, and susceptibilities, the scientist sees an example of the process of evolution, so familiar that it fails to excite any special notice. The less experienced observer, with a larger perception of the marvellous, cannot avoid being impressed with the remarkable results of apparently simple causes. Opponents of the theory of evolution have found some

amusement in quoting with derision the statement which someone is supposed to have made, that man arose from the jelly-fish by a series of developmental changes occupying ages. Most probably no one has been asked to believe in such an origin of the human race; but it may be worth while to think for a moment on the facts which have just been recorded, about which there is no dispute, all tending to prove that an organism much less advanced in the scale of creation than a jelly-fish, being, indeed, only a speck of germinal matter, is capable of evolving a man.

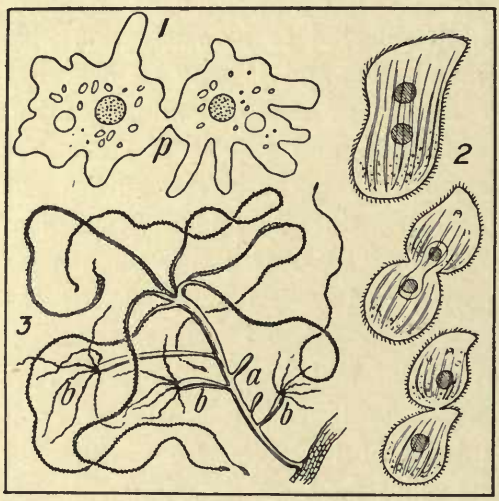


Fig. 543.—Examples of Multiplication by Division and by Budding

1. Amœba; *p*, point of separation. 2. Chilodon cucullulus; successive stages of division. 3. Hydra fusca; *a*, very young buds; *b*, older buds at different stages.

The mammalian ovum is in reality a minute speck of animal matter having no individuality, a simple cell formed by investing membrane surrounding an albuminous mass, having a diameter of less than the $\frac{1}{1000}$th of an inch, containing a germinal vesicle and a germinal spot only visible under the highest powers of the microscope. It is but required that the minute germ in the egg, or ovulum as it may more appropriately be called, should be fertilized by contact with the male sperm to ensure the development of a man, or a much larger mammal, not during the course of ages, but in a few months. If it could be demonstrated that the higher mammalian is the outcome of inconceivably prolonged transformations in the organism of the jelly-fish, it is difficult to understand that there would be any greater ground for wonder than should naturally be, at the contemplation of the metamorphosis of the mammalian ovum, ending in the evolution of the highest animal in creation.

Multiplication of the species in the minute, lowly-organized beings which may be described as constituting the dawn of life, is effected by processes which may be termed marvellous in their extreme simplicity.

Taking **the amœba** for an example, we have a mere film of transparent germinal, *i.e.* living, matter, capable of movement without any discernible organs of locomotion, breathing without any respiratory apparatus, and taking necessary nutriment and growing thereby without a trace of digestive organs. Multiplication of these primitive forms of

living things is the simple result of the separation of portions of the mass, which are at once new beings possessing all the powers and properties of their parent. Among the Infusoria, the highest division of the Protozoa, there are endless varieties of form, most of them moving freely in the fluid in which they live, by the aid of fine hair-like projections (cilia), although some of them have a stationary life, being attached to stones or other bodies. Their reproductive powers are always active, and result in the growth of buds, which project from their bodies, become severed from their parents, and enjoy an independent existence, giving origin to new lives by the simple process of budding in their turn. Division of the organisms is another method of multiplication which is common. The *paramecium*, for instance, has been seen to divide into several parts, which go on dividing every twenty-four hours. Monads, which are the smallest of infusorial animalcules, exhibit phenomena closely allied to those which have been described in the early changes in the mammalian ovum, *i.e.* multiplication by cleavage. A small fissure is observed in the cell wall at two, sometimes at four, points, and by the simple extension of the fissures the creature is converted into two or four individuals.

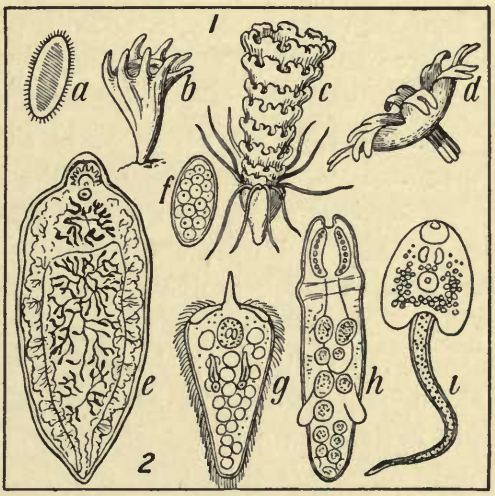


Fig. 544.—Alternate Generation

1. Chrysaora (Medusa): *a*, egg; *b*, Hydratuba stage; *c*, Hydra undergoing subdivision; *d*, young medusa detached. 2. Distomum hepaticum: *e*, adult; *f*, egg; *g*, larva (1st generation); *h*, redia stage (2nd generation); *i*, cercaria stage (3rd generation).

Alternate Generation.—Among the variations, some of which have been described in the function of generation, that of alternate generation is the most remarkable. It has been aptly defined as the production, by an animal, of an offspring which at no time resembles its parent, but which itself brings forth a progeny which gives rise to other forms still differing from the parent animal, so that the original maternal animal does not meet with its resemblance in its own brood, but in its descendants of the second, third, or fourth generation. This paradoxical position of the reproductive function is not exceptional nor even rare. Vertebrate animals are the only class in which it has not been observed. In bell-shaped Polypes, Claviform Polypes, Medusæ, Salpæ, Vorticellæ, and Entozoa it is well known. The last-named class, Entozoa, and

Insects, furnish not only most striking, but also easily recognized examples.

Flukes, which occur in the ducts of the liver of various animals, horse, sheep, and cattle, and tape-worms, which inhabit the intestines, are among the most instructive instances of alternation of generations.

A few lines will suffice to describe the curious metamorphoses, the elucidation of which has occupied scientists for years of patient labour.

Stock-owners are well aware of the effects of the invasion of the liver of the sheep by the common fluke. This parasite is in form something like a flounder or minute sole, about an inch in length when fully grown; its digestive tubes are usually filled with bile. The reproductive system is highly developed, male and female organs existing in the same creature. Millions of eggs are deposited in the ducts of the liver of the sheep and other animals, and carried into the intestines along with the bile, finally being expelled along with the excreta. Falling on moist ground, the eggs are hatched, and from them emerge—not young flukes, but long, ciliated embryos, as much unlike the parent as the most erratic imagination can realize. Now the changes begin; the long embryo swimming about finds a snail, the shell of which it pierces, and lodges itself in the body of the animal, and becomes a "sporocyst", which means a cell full of germs. This is the first generation. The germs are developed, and become more highly organized than the embryos were, and are called "Rediæ" (second generation). The Rediæ escape from the parent cysts and lodge themselves in various parts of the snail; meanwhile, inside these Rediæ long-tailed Cercaria are developed (third generation). Some of the Cercaria, which are tadpole-like creatures, wriggle out of the snail and enjoy for a brief space a free life of swimming in the pools and puddles of wet grounds. Soon, however, they fix themselves on grasses and other plants growing in water, exude a gummy substance, and form little cysts, in which the Cercaria, the inchoate fluke, is enclosed. In this state they remain until they are swallowed by a sheep or other warm-blooded animal, when they escape from their slight prison, find their way to the liver ducts, and assume the form of minute flukes (fourth generation, from the egg of the parent fluke).

To put the case in one view, one fluke egg gives exit to one embryo, which becomes one sporocyst, in which many Rediæ are developed. In each Redia sac numerous Cercaria of the tadpole shape, the fluke of the next generation, are formed and set free. Thus a single fluke egg is calculated to be responsible for at least 200 Cercaria. Leuckhart has estimated that the oviduct of a fluke may contain 45,000 eggs; it is only necessary to multiply that number by 200 to arrive at the total number of young flukes

which one fluke may produce. The whole story sounds like a fairy tale; it is, however, a true story every whit.

Only less marvellous is the history of the generation of the tape-worm, which in every mature joint produces myriads of eggs, each containing a living embryo, globular in form and armed with six minute hooklets, which have a purpose presently to be divulged. Mature joints or segments are constantly being expelled from the intestines of infested animals, lambs, for example, and are, as a matter of course, eaten with herbage by other grazing animals. Reaching the digestive organs of the warm-blooded animal, the eggs are set free, the armed embryos find their way, by the aid of their hooklets, to certain organs, lungs, liver, or brain, fix themselves securely by the little hooks, and grow into water-bladders (hydatids), sometimes of great size. In the interior of the hydatid there are to be found numerous minute germs,—sometimes the numbers cannot be estimated,—which are in reality tape-worm heads and necks, ready to grow joint by joint, until they reach several feet or yards in length. The hydatid is swallowed by a dog or other carnivorous animal, and tape-worms are again developed.

These two examples of alternation of generations may suffice. Obviously the scheme has enormous advantages on the side of multiplication of species with an abnormal rapidity, and it is a startling reflection that the creatures thus liberally distributed over the world are destined in their struggle for existence to inflict disease and death on creatures higher in the scale of creation than themselves, undiscovered, even unsuspected.

PHYSIOLOGY OF GESTATION AND PARTURITION

IMPREGNATION

Successful horse-breeding demands a special knowledge of horses, so far as concerns their external conformation, aptitudes for different services, and peculiarities and defects; and in its practical aspect it requires also a sound knowledge of horse-rearing and management, particularly of the young stock, and of mares during pregnancy and parturition, and for some time after that event. Constant care and attention are likewise needed on the part of those entrusted with the carrying out of the details of breeding, in order to avoid accidents and ensure a satisfactory result.

The age at which horses commence to breed depends to some extent upon race peculiarities and external conditions, which have an influence in

promoting precocity or retarding puberty. Well-bred animals are more precocious in this direction than those which are under-bred, and an abundance of rich stimulating food, easy labour, and comfortable surroundings expedite the development of the procreative faculties. The male and female horse are capable of breeding at two years of age, but instances are on record in which yearling colts and fillies have copulated successfully, and foals have been born before the parents were two years old.

The duration of the period during which procreation is possible is also dependent upon circumstances connected with breed, management, and surroundings. The stallion may continue potent until over thirty years of age, and mares have been known to produce foals when twenty-eight, thirty-two, and thirty-eight years old.

But it may be accepted as a rule that stallions and mares are at their best from four or five years, until they are about sixteen years old. When immature from youthfulness, or stale and decrepit from old age, the progeny of such animals cannot be expected to have the constitutional stamina or perfection of form of stock derived from parents in the bloom of life.

The mare is usually "in season" (ready to receive the stallion) from April to June, or even later, and the periods when conception is likely to take place during that time recur about once a fortnight or three weeks, and are very brief in some mares—only of two or three days' duration. The indications of this condition (æstrum) are generally well marked: the animal is usually irritable or sluggish, and less able to sustain severe exertion; the sensibility is increased, and the appetite is more or less in abeyance or capricious, and thirst is often present; there is a tendency to seek the company of other horses, especially males; attempts to pass urine are frequent, and there are spasmodic ejections of a whitish fluid, accompanied by movements of the vulva. While these symptoms continue, the mare will readily receive "service", and fecundation then most certainly occurs,—though it must be remarked that they often persist continuously in certain mares, and "service" does not allay them, neither does pregnancy result from such service, as they are mostly due to an abnormal condition of the ovaries. (See page 180 of this volume.)

When conception has taken place, these symptoms, as a rule, do not recur at these usual periods, and are not witnessed during the whole time of pregnancy,—though now and again instances are noted in which one or more of them are observed, and pregnant mares will sometimes accept the stallion, instead of repelling him, as is usually the case, though he rarely shows any desire to have intercourse with mares when they are in foal.

When conception has taken place, the signs of heat or rutting, as has

been said, subside, and are not again noticed until after parturition; they reappear, however, very soon after that act has taken place, and it is believed that on the ninth day subsequent to foaling, the mare will be more successfully impregnated than at any other time.

With some mares impregnation does not take place readily, and this fault may be due to various causes, such as the animal being too old when tried for the first time, too fat or debilitated, &c., in which cases medicines which stimulate the generative functions, such as cantharides in very small doses, tonics, or stimulating food, may be of service. For other cases in which the cause is located in the organs of generation, the remedy to be resorted to will depend upon the character of the obstacle. The most frequent of the causes which hinder or prevent impregnation and produce sterility appears to be one of a mechanical kind—closure of the small opening (*os*) in the neck (*cervix*) of the uterus, leading to the interior of that important receptacle. This can only be ascertained by a manual examination, which discovers the opening into the uterus to be impervious, through contraction or alteration in structure of the neck of that organ. For very many of those cases the canal can be dilated by the fingers immediately before the mare is brought to the stallion; and great success has attended the employment of the india-rubber impregnation-tube, which is inserted into the canal before service, and withdrawn when that has been effected.

When impregnation has been successfully accomplished, certain changes are usually observed in the behaviour of the mare which lead to the supposition that such is the case. Perhaps the most notable indication is the disappearance of "æstrum" or "heat". It is ordinarily the practice to present a mare to the stallion nine days after she has foaled, this being the time at which, as has been already stated, conception is popularly believed to take place with most certainty. About a fortnight afterwards she is again presented, and generally in another fortnight a last trial is made, when if the animal refuses intercourse it is concluded that she is pregnant, especially if no unfavourable signs have been observed in the interval, such as a desire for the male.

In a short time, also, the majority of mares, if they have been irritable and restless previously, become quieter and more docile, if not absolutely torpid, and inclined to become fatter. Seldom is anything more noticed until pregnancy has advanced to the sixth or seventh month; so that though the question is often asked the expert as to whether a mare is in foal before that period, a reply in the affirmative is rather hazardous, and can only be based on the indications just alluded to, unless recourse be had to a manual examination per rectum or through the genital passage, a procedure which is not advisable in all cases.

But about the sixth or seventh month an attentive observer can generally detect an enlargement of the abdomen, more particularly on the right side, and movements of the young creature can also be seen in the region of the right flank, and most probably after the mare has been drinking cold water. The expert may also be able to hear the beating of the fœtal heart.

From this time onwards the size of the abdomen gradually increases, and it becomes more pendulous and prominent, though the volume varies in different mares, the variation depending not only upon a difference in the size of the foal, but also upon the amount of the fluid which surrounds it in the uterus, this being much greater in some mares than others.

When the term of pregnancy is nearly completed, not only is the abdomen increasingly larger and more pendulous, but its upper part on both sides towards the spine begins to fall in, this hollowness being very marked immediately before parturition. A waxy matter also forms on the teats, and the udder becomes enlarged, this enlargement being generally coincident with the appearance of a thin discharge from the teats. The mare becomes sluggish, is readily tired, and seeks for rest and tranquillity, though the appetite, which has been greater during the later months of pregnancy than before, is usually unimpaired. A few days before foaling the croup sinks on each side of the root of the tail, and sometimes the hind-limbs swell slightly.

CARE OF THE MARE DURING PREGNANCY

During the early months of pregnancy the mare demands no special care beyond that included in the term "good stable management", and usual labour can be exacted with impunity. But towards the sixth month she should be more carefully treated than she would be if not in foal. If she is worked, and especially if the work should chance to be of a fast kind, then it ought to be, if possible, not so rapid, and be gentler and more uniform—violent paces or irregular and severe efforts are attended with danger, all the more imminent as pregnancy is advanced, and particularly so towards its finish. Within a week or two of foaling all work should cease, but exercise ought to be allowed if the mare is not in a paddock, though with care farm-mares may be permitted to do light, steady labour until within a few days of foaling. It must be remembered that exercise is beneficial, and indeed necessary, for all breeds of mares during pregnancy; but if they are allowed to run out-of-doors this should be on as level ground as possible, with a soil in which the feet will not sink, and without ditches or holes.

Mares when in foal, and especially when near foaling time, have a

greater tendency to indulge in rolling than at other times when lying down, and if there are hollows, open drains, or ditches, they may become fixed in one of these, and in their struggles to get up so strain themselves as to make parturition difficult, or lead to abortion or death of the foal. All the walls or fences enclosing the fields or paddocks in which pregnant mares are kept should have no gaps or stakes projecting inwards, and all doors and gates through which such animals may have to pass ought to be sufficiently wide to permit them to pass through quite easily. Pregnant mares should not be pastured with young horses or cattle, nor exposed to anything likely to cause excitement.

The same care ought to be observed if the mare is stabled. She must be protected from annoyance or injury by other horses, and if kept in a stall this ought to be of ample width, to allow her to turn round easily in it. The floor should also be as level and horizontal as possible, so that the mare may stand and lie easily, and the weight of the abdominal contents not be thrown too much backwards. The mare should also be fastened by the head in such a manner that there may be no danger of her getting cast.

But it is always judicious to have a mare about to foal kept in a convenient loose-box or temporary shed, where there is plenty of room for her to move about, with protection from inclement weather, freedom from draughts of cold air, and good ventilation.

For litter, straw is suitable, though when parturition is near this should not be new, as some mares have a kind of morbid appetite at this time and would consume it greedily, thereby producing abdominal distention and consequently dangerous pressure on the uterus and its contents. Long new straw also becomes twisted and rolled round the feet, and so impedes movement. It is therefore advisable to use slightly soiled but dry litter that has been under other horses—this is soft and broken, so that the mare's feet will not become entangled in it, and being soiled she will not eat it.

With regard to food, the kind and quantity allowed will depend upon the stage of pregnancy which the mare has reached. If she is working, the quantity and quality should be sufficient to maintain her in good health and efficient condition—if anything it ought to be better in quality and a little more in quantity than that given to similar-sized horses not in foal, and it should, if possible, be presented more frequently. Whether the mare is or is not working, it is advisable not to allow her to become fat —indeed it is preferable to keep her in what might be termed moderate condition. There is nothing better than good hay and oats for pregnant mares; but for farm in-foal mares at work, mashes, or bruised oats or barley mixed with pulped roots, and chopped hay or straw damped with

linseed-cake water, have been recommended. Maize is generally considered unsuitable for pregnant mares.

Many mares at pasture receive nothing but the grass they pick up, and when there is plenty of this and it is of good quality, the mare may do well and produce a well-developed foal; but during unfavourable weather, or when the pasturage is scanty or poor, a suitable quantity of hay and oats should be allowed, especially for morning feed; indeed at all times an allowance of oats, even if small, is advantageous.

All food should not only be of good quality, but be also capable of easy digestion. When the mare is near parturition she may beneficially, two or three times a week, have mashes of boiled linseed mixed with bran, and made more enticing by the addition of an ounce or two of salt in each mash. A very excellent adjunct to the diet is a lump of rock-salt placed in a position where the mare can conveniently get at it to lick it.

Medicines should never be administered to pregnant mares except under skilled advice.

With regard to drink, the water should be clean and pure, and allowed frequently. If the mare is stabled it should be always beside her, as then there will be no danger of her drinking too much at a time. Soft water is better than that which is hard.

ACCIDENTS INCIDENTAL TO PREGNANCY

As will be seen, much of the success that should attend horse-breeding depends upon the care and attention bestowed upon the mare towards and at foaling time, as then not only are her own health and safety at stake, but the welfare of her progeny is also a matter for serious consideration. But if suitable precautions are adopted and intelligent observation maintained, the mare and foal usually pass through this critical period of their existence in a satisfactory manner. It is certainly true that in very many instances pregnant mares receive little notice beyond that given at other times, and are often hard-worked and exposed to all kinds of unfavourable treatment. This is more especially the case with animals belonging to poor people, and particularly farmers in a small way of business, who exact labour from their mares almost up to the day of foaling, and set them to work again after that event has taken place. But this treatment is not always pursued with impunity, for accidents of a serious kind often occur, and sometimes the foal, sometimes the mare—not infrequently both—suffer disastrously. And it is no less true that common-bred animals are less predisposed to accidents at this time than those which are high-bred

—high-breeding bringing in its train greater liability to certain accidents incidental to pregnancy and parturition. High-bred animals therefore require more careful supervision on the part of the breeder.

Abortion.—Abortion and premature birth are the most serious accidents that can happen to pregnant mares. Though both terms are often applied indiscriminately, "slipping the foal" is the term generally employed when the young creature is expelled at any time before it is fully developed and the usual time of pregnancy has expired; yet it is recognized by those who make this subject their study that the term "abortion" should imply expulsion of the fœtus from the mother when it has not attained sufficient development to live outside its mother's body, while "premature birth" signifies that the young creature has been born before its time, yet with all its organs sufficiently formed to enable it to live for at least some time in the external world. In the first instance it is either dead when expelled from the uterus or it dies immediately afterwards; and in the second it may be weakly and immature and succumb after a variable period, or it may continue to live and eventually thrive. In practice, however, there is no accurately defined limit between abortion and premature birth, and especially when the latter has been brought about by any one of the causes that produce the former.

Abortion is said to take place in mares when the fœtus is expelled forty days before the usual period of pregnancy has terminated, and though it may occur at any time during pregnancy, especially before the 300th day, yet it is much more frequent during the first than the second half of pregnancy. When the accident takes place at a very early period it may not produce any appreciable disturbance in the mare's health, and the developing ovum usually escapes intact and often unperceived; but when it occurs at a later stage it is serious, as it not only entails the loss of the foal, but may also compromise the health, or even the life, of the parent.

Many causes operate in bringing about abortion, and some of these have been mentioned; they act more or less in a mechanical manner, and usually only one mare in a number will abort. But when several cases follow each other quickly in a breeding establishment, and no sufficient reason can be assigned for their occurrence, then the question of infection arises, and there can be no doubt now that to this cause must be ascribed the serious outbreaks of abortion among mares in recent years in various parts of Europe, but more especially in the United States of America, where heavy losses have been sustained.

When, therefore, two or three abortions happen in a stud, it is well to adopt precautions at once; indeed, where a number of pregnant mares are kept, such precautions ought to be resorted to when only one accident of

this kind transpires, as no one can foretell whether it may not be the starting-point for others.

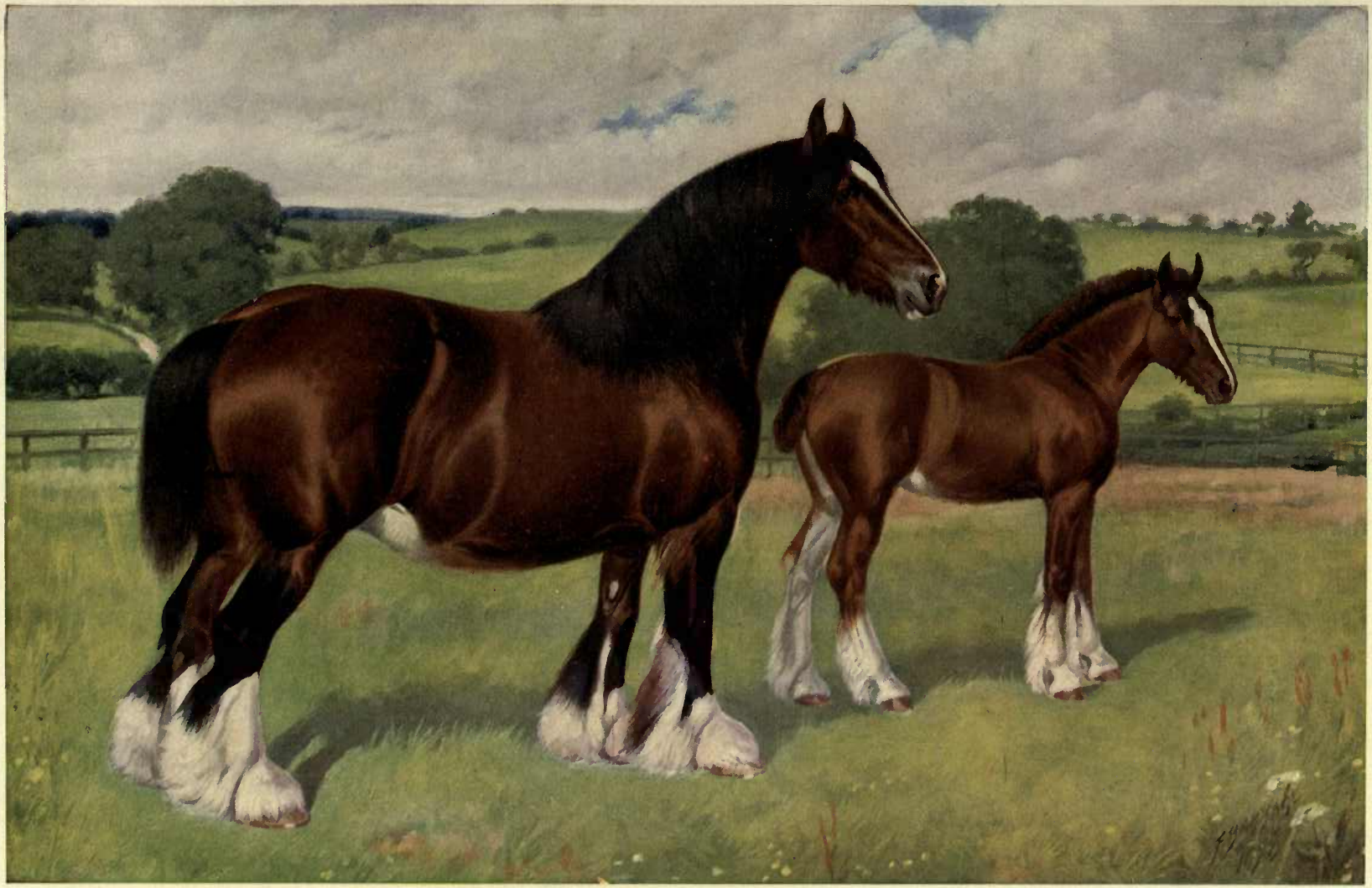
If it could be arranged for every mare advanced in pregnancy to be kept by herself in a loose-box and paddock, it is very probable that this serious risk might be obviated; at any rate, isolation and other measures could be more readily and effectually applied.

As a preventive of this form of abortion, the surroundings of the pregnant mare should be as clean as possible, and all decaying or putrid animal or vegetable matter ought to be kept away from her. Cleanliness, good food, and pure air and water are the only efficient protectives that can be recommended against abortion, beyond those already mentioned.

When a mare shows signs of impending abortion, if she is not already housed and by herself, the first thing to be done is to remove her to a spacious loose-box, which ought to be kept rather dark, and free from noise. These signs, however, are not very obvious in all cases. Sometimes it happens that the mare appears to be as lively and well as usual up to the moment when the fœtus is expelled, while the expulsive act itself is so sudden and quick, and accomplished with so little visible effort or disturbance, that the accident excites very little if any notice. It frequently happens during the night, and surprise is expressed at finding in the morning the aborted fœtus, usually contained in its intact envelopes, lying behind an animal which on the previous evening looked perfectly well, and even now is so cheerful and unaltered, and its functions so little impaired, that it can scarcely be believed she has been the subject of such a grave mishap. Even the sentiment of maternity, which is so strongly developed in animals after carrying the young full time, is not awakened in her, and she shows the utmost indifference to the fœtus, even treading upon it.

When abortion takes place during the day, the flanks have been observed to fall in a little, the abdomen descends, the vulva and vagina slightly dilate, and there escapes from them a glutinous, reddish-tinged fluid, followed by the fœtus. If abortion occurs at an early period in pregnancy, the membranes in which the young creature is enclosed are not ruptured; but when the period is more advanced—it may be towards the seventh or eighth month—these envelopes rupture before expulsion of the fœtus, and may be retained in the uterus or ejected soon afterwards.

In other instances, however, especially when pregnancy is well advanced, and particularly if the mare has sustained external injury, there are precursory signs of abortion which the attentive observer may note, but which vary to some extent, according as the fœtus is dead or alive. The mare suddenly appears dull and dejected, or is restless, uneasy, and constantly moving about. If the fœtus is alive and strong its movements are—by



SHIRE MARE AND FOAL, WYKEHAM MABEL

one watching the mare's abdomen—perceived to be frequent, violent, and disordered, but they soon become feeble and infrequent, and cease altogether when it has died. The mare shows symptoms of illness, and these are soon succeeded by those that characterize ordinary parturition, and spontaneous birth of the dead progeny takes place, or, in rare instances, it may be necessary to remove it manually.

In other instances, when the fœtus is not removed from the mare spontaneously or artificially after it has ceased to move in the uterus, the mare regains her ordinary tranquillity, appetite, and liveliness, and all the symptoms disappear for one or more days, when they are again manifested, and the fœtus may be expelled without any apparent effort, or after much straining.

When it is observed that abortion is likely to occur, it is advisable to obtain professional advice as soon as possible. If the accident has already occurred, however, then, if other pregnant mares are near, they must be at once removed to a safe distance from the place, which should be cleaned and disinfected as soon as possible. Everything in the way of litter and remains of fodder, together with the fœtus and its envelopes, ought to be burned, and the ground well scraped and disinfected. The hind-quarters of the mare should also be washed with carbolic water, Condy's fluid, or solution of corrosive sublimate (1 per 1000); one of these fluids, warm, should also be injected into the uterus if this is emptied of its contents. Until all this has been done, and some days have elapsed, the mare must not be allowed to associate with in-foal mares. It is also advisable to prohibit persons who have attended on the mare approaching these until they have at least been disinfected.

It is a wise measure to keep pregnant mares away from horses affected with infectious or contagious diseases, such as influenza and strangles, as, if they become affected, they may abort, or the maladies may be transmitted to the progeny.

PARTURITION

The duration of pregnancy in the mare is usually about eleven months, though it may vary between ten and twelve months, or even more. The normal duration is, however, between 330 and 350 days. Some foals may be born alive from the 300th to the 310th day, but this is rare.

Breed and feeding have some influence on the duration of pregnancy. In high-bred and well-fed mares it is generally shorter than in under-bred, badly-cared-for, and hard-worked animals.

Allusion has already been made to the signs which indicate that this period is drawing to a close, and it is necessary that these should be noted

and acted upon, so as to be prepared for the birth of the foal; and when the event is imminent, a visit should be paid to the mare frequently by night and by day.

Birth of the foal, when all things are favourable, takes place very rapidly, and in the great majority of cases the mare requires no assistance. When the labour pains come on, and she begins to strain energetically, the foal is propelled backwards, with the fore-legs leading, and the head between them. These soon appear externally, usually surrounded by the membranes and the fluid contained in them. A few more strains and the

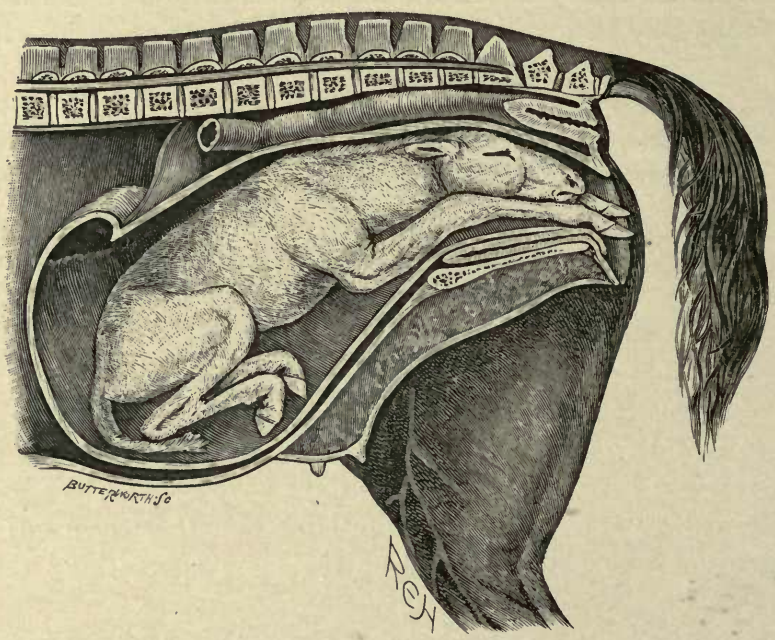


Fig. 545.—Natural Presentation

membranes are ruptured, when the foal glides gently down over the mare's hocks, if she is standing—which is generally the case—and falls softly on to the ground; the navel-string (*umbilical cord*) is nearly always torn through during this descent of the foal.

The mare, soon after its birth, cleans the foal by licking it all over, and when this is done it is well to offer her a bucket of warm oatmeal or linseed gruel, and some bran mash, but otherwise she ought to be interfered with as little as possible. In some instances the mare refuses to have anything to do with the foal, and even becomes aggressive towards it. In such cases it has been recommended to sprinkle the foal's back with flour, as an inducement for the dam to lick this off, and so to become attached to her progeny.

The expulsion of the membranes, or "after-birth", sometimes takes

place with the birth of the foal, but it is generally subsequent to that event within a few hours. If they are retained until they begin to putrefy, serious consequences may ensue; it is necessary to remove them in a day or so. If they are apparent, or readily accessible to the hand, they may be gently twisted round like a rope and slightly pulled upon until they are brought away. If this procedure is not successful, then the hand and arm, well soaped or oiled, must be introduced into the uterus, and the membranes seized, disengaged from their attachments, and completely removed from the mare. This attempt is all the more urgently necessary when there is a foul odour from the membranes and a bad-smelling discharge from the vagina, the mare at the same time making attempts to strain, and looking feverish. Then not only must every portion of these membranes be removed from the uterine cavity, but this must be thoroughly cleansed by copious injections of warm water, to which a small proportion of carbolic acid has been added, and scrupulous cleanliness should be observed with the mare's hind-quarters and her surroundings.

Sometimes the mare, from debility or other cause, foals while lying down, and unless she gets up immediately the foal is born, the navel-string is not torn, so that the young creature may remain attached to its parent through this medium unless some accident release it, either the cord being ruptured or the membranes dragged from the uterus. If an attendant is at hand, however, the foal can be readily disengaged if he ties the cord firmly round with a piece of string in two places, about 6 or 8 inches from the foal, and cuts in through between the ties; this prevents bleeding from the mother and from the foal.

Difficult Parturition.—Though parturition is generally and apparently an easy and prompt act in the mare, yet it is not always so; on the contrary, in some instances it is extremely complicated and difficult, and many of these cases have a rapidly fatal termination. Hence the great need for careful observation of the mare at this time, for when the foal presents itself in the genital passage in an unfavourable position or abnormal attitude, unless the attendant have skill and experience it will fare badly with the mare, unless the assistance of an expert can be speedily procured, as she—unlike the cow—unless soon delivered, quickly becomes greatly excited and restless, and even furious. All veterinary surgeons who have had to deal with cases of difficult birth in mares are well aware of the herculean and dangerous task that often lies before them, when they are called upon to attend such cases, owing to the excitement, uneasiness, and only too frequently mad plunging of the animal, which is all the greater as parturition is protracted.

For this and other reasons it is imperative, if the foal is not born very

soon after straining commences, that an examination should be made, and if the cause of obstruction cannot be discovered or speedily removed, then the veterinary surgeon ought to be called upon to render assistance with as little loss of time as possible, as every minute's delay increases the gravity of the case.

If the attendant possesses sufficient knowledge of veterinary obstetrics to enable him to deal with a comparatively simple case of difficult parturition when skilled assistance is not immediately available, then, of course, he will first make an examination in order to inform himself of the cause of

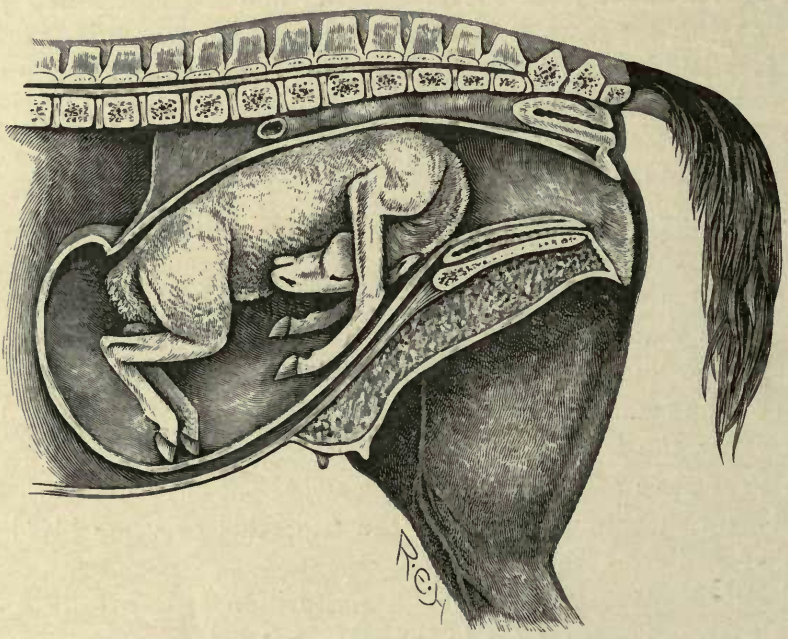


Fig. 546.—Neck Presented, Fore-legs directed backwards

obstruction to delivery. Should he find the foal in a favourable position, with the fore-legs presenting and the head forward or resting upon them, with sufficient room for the young creature to pass through the canal, then prudence may induce him to wait a little, as the labour pains may not be strong enough to produce its expulsion. If, however, the position of the foal is not favourable to speedy birth it must be rectified, or if the labour pains are feeble, even when the position is good, and especially if some time has elapsed, then in both cases, steady and firm but not violent traction may succeed in effecting delivery. It should be noted that some old mares have a large pendulous abdomen, which is a hindrance to foaling, as the young creature is so much below the level of the passage through which it has to pass to reach the outer world, that the abdominal muscles—which are those chiefly concerned in the expulsion of the foal—cannot raise it

high enough. In such a case it is most advantageous to elevate the abdomen by means of a sack passed beneath it, and lifted up by strong men at each end.

When the foal itself is the cause of obstruction, this may be due to the position of the limbs, body, or head. The fore-limbs are perhaps most often at fault, and one or both are involved, the difficulty being generally caused by their being doubled back at the knees (fig. 546). A similar flexion of the hind-limbs at the hocks may occur and be a cause of difficult parturition. The head, instead of being placed nose forwards and between

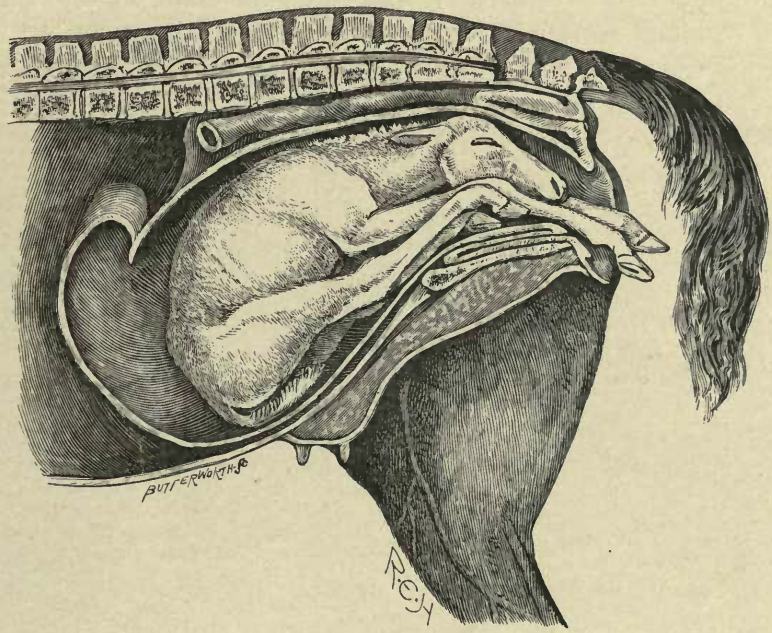


Fig. 547.—Head and all Four Legs presented

the fore-limbs, may be bent downwards towards the foal's chest (fig. 546), or it and the neck may be thrown upwards and backwards, or towards the side of the foal's body. Instead of the head and fore-limbs coming first, it may be the hind-limbs, or these may be retained and only the tail and buttocks presented (figs. 551, 552), while the body itself, instead of the back being towards the mare's back, may be reversed, the young creature lying more or less on its back with the legs upwards.

Besides all these and other malpositions or malpresentations here represented, there is the difficulty sometimes—though not very often in the case of mares—occasioned by the presence of twins, as well as the occurrence of monstrosities, and serious deformities or morbid conditions in the foal. Deformity or diseases in the mare causing narrowing of the genital passage may also be a cause of hindrance to birth.

In cases of difficult parturition in the mare, much skill, adroitness, patience, and resource, as well as physical strength and agility, are required in dealing with the very numerous and diverse obstacles that have to be encountered and overcome if the lives of the foal and mother, or either, are to be saved. More especially are judgment and manual tact required in making an examination. This demands not only a thorough knowledge of the internal anatomy of the mare's generative organs, healthy and pathological, but also an acquaintance by touch with all the surface and different regions of the foal's body and limbs. Without this knowledge and tactile facility it may be impossible to understand the hindrance to birth, and to render assistance by adopting proper measures or resorting to effective manœuvres. So that the amateur or unskilled operator is likely to do more harm than good, and may even unawares convert what to an expert would prove a comparatively simple case, into a most difficult if not altogether hopeless one.

MALPRESENTATIONS

Head Presented, Knees Doubled Back.—To effect delivery while the foal is in this abnormal condition (fig. 548) is practically impossible.

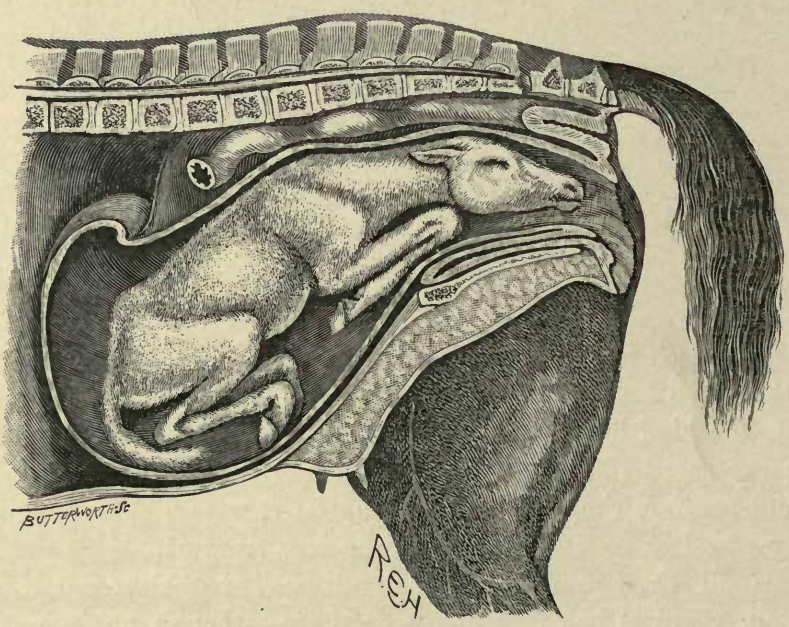


Fig. 548.—Head presented, Knees doubled back

What is required is to bring the legs into the position of a natural presentation, *i.e.* into the passage, with the head resting upon them. To effect this the canon bone must be straightened on the knee and the leg

extended. The limb most easy of access is the first to be dealt with. If the head is in the passage it must be forced back into the uterus by planting the flat of the hand on the front of the face. When necessary, this may be effected with a crutch made to press on the front of the chest. While this is being done by an assistant, the operator will pass his hand along the under side of the neck until the forearm is reached. A push in a backward direction should then be made, until the arm can be raised and the leg brought bodily forward. The hand should now pass down to the canon, seize it, and through it push the knee up towards the neck.

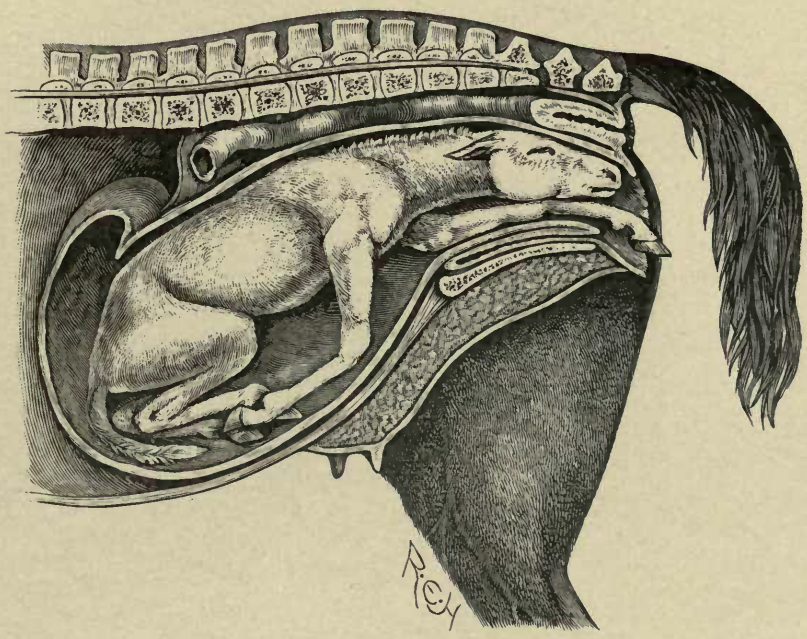


Fig. 549.—One Fore-limb displaced backwards

The hand while drawing the limb forward gradually moves towards the pastern, which it firmly grips, and after extending the fetlock-joint, draws the foot into the passage. The limb having been secured by cords, the recovery of the next one may be proceeded with, after which delivery will be effected in the usual way.

Still more difficult is that presentation where one fore-limb with the head is in the passage, and the other is lying far back under the body (fig. 549). Here the advantage of a long arm and a strong man to use it will be clearly obvious, for, as in the last presentation, the success of the operation will depend upon the displaced fore-limb being secured and brought into position. The passage must first be cleared by pushing back the head. The hand should then be passed along the under part of the neck, should seize the fore-arm and bring it forward into the passage.

If this cannot be accomplished, then the front parts of the dam must be raised by underpacking the fore-feet with litter so as to give the body an inclination backward. When the forearm is reached the hand should follow it downward to the knee, or as near it as possible. The limb is then firmly grasped and drawn forwards.

When the arm has been brought in a straight line with the pelvic inlet, it should then be used to push the body backward and clear the way for the leg being brought into the passage. To do this it may be

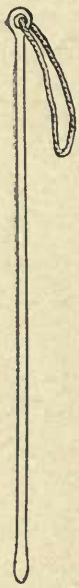


Fig. 550.—Porte-cord

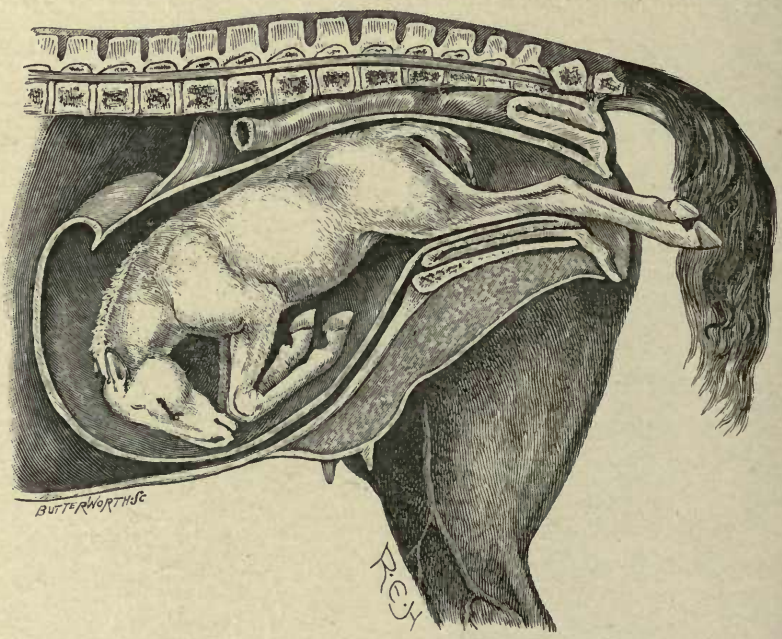


Fig. 551.—Breech presentation, Hind-legs in Passage

necessary to push the body back into the uterus with a crutch implanted against the breast.

If it should happen that the arm cannot be reached, an attempt must be made to pass a cord round it by means of a Porte-cord (fig. 550). Should such an instrument not be at hand, a hooked walking-stick carrying a cord through a hole in the handle may be employed. The leg will then be pulled forwards by assistants, while the operator, seizing the canon and then the pastern, will engage himself in directing it into the passage.

Posterior or Breech Presentation.—The breech of the fœtus may be presented either with the hind-legs in the passage (fig. 551) or projected forward under the abdomen (fig. 552). In the former position delivery may be effected without assistance, but it is always desirable to afford help promptly where the least difficulty arises. This position is the most favour-

able breech form of presentation, since it requires no readjustment of parts. All that is necessary is to supplement the natural force of the throes with manual assistance from without.

It is otherwise where the hocks are flexed and presented with the breech, and the legs extend forward under the belly (fig. 552). In this presentation there is danger of the parts being wedged in the pelvis, and so fixed as to render a proper adjustment difficult if not impossible. Before delivery can be effected in this case the direction of the hind-limbs must be changed and they must be brought into the passage. To effect this

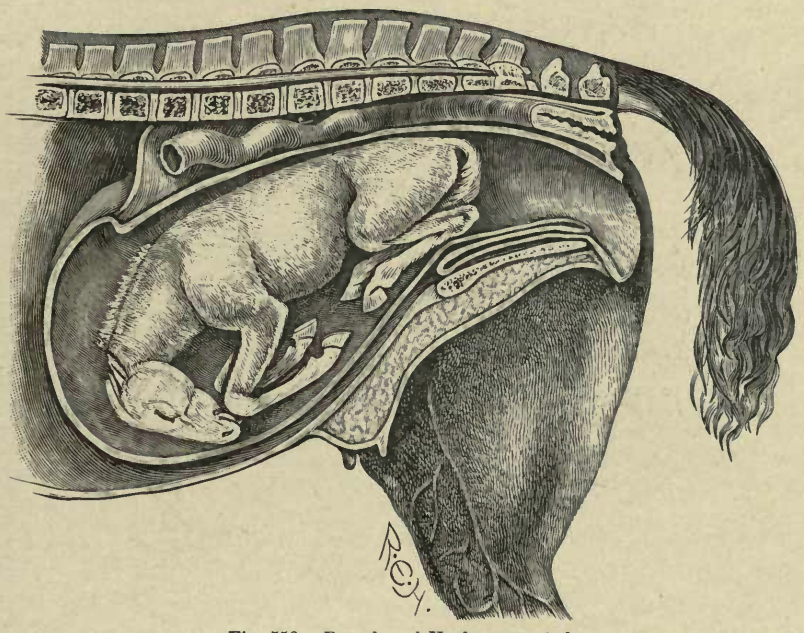


Fig. 552.—Breech and Hocks presented

it is necessary that room be provided by forcing the buttocks in a forward direction so as to clear a space for bringing up the hind-limbs. In performing this task, advantage will be obtained if the hind extremities of the mare be raised by underpacking with litter or some other suitable means. A forward and downward inclination will thus be given to the fœtus, and the resistance to pressure from behind thereby reduced. When this has been done, an attempt should be made to force the body of the foal forward, either by means of the hand or a crutch (fig. 558) applied to the buttocks immediately below the tail. In this connection it is necessary to point out that the force employed should not be sudden and spasmodic, but steady, continuous, and progressive. The intervals between the throes are periods when the fœtus will yield most to pressure, and the advantage gained at these times should not be lost, if possible, when straining returns.

Room having been thus provided, an attempt should now be made to bring the hind-legs into position for delivery. For this purpose the palm of the hand should be placed against the under side of the point of the hock, and pressure made in a forward and slightly upward direction upon the second thigh. If by a little manœuvring a cord can be placed round the bend of the hock, it should be done and handed to an assistant, who will be able to render considerable help by pulling the limb backwards when the right time comes.

The operator should now grasp the shin-bone, and with such help as his

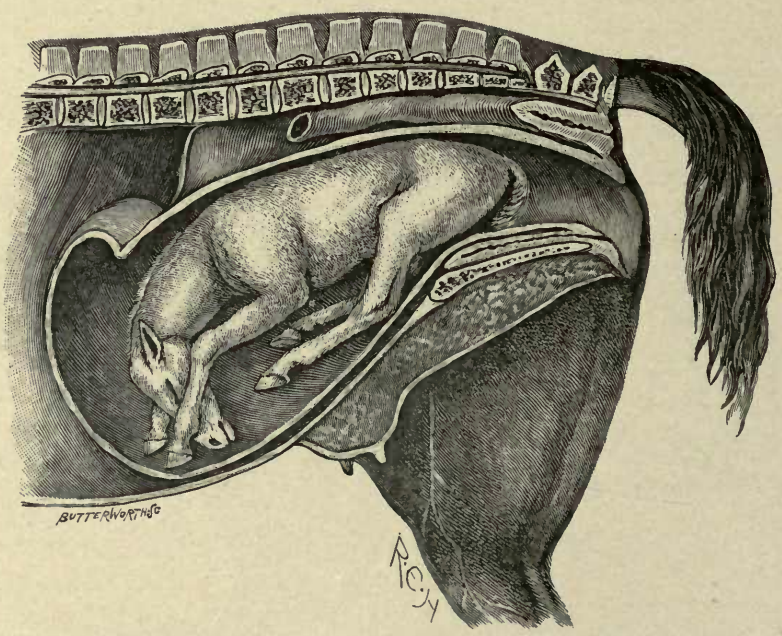


Fig. 553.—Breech presentation, Legs extended beneath Abdomen

assistant can give him, draw the leg towards the pelvic inlet. As soon as the pastern or the foot can be reached, the fetlock-joint should be forcibly flexed and the leg lifted into the passage. Before this can be done it may be necessary to pass a cord round the pastern and bring traction to bear upon it, while the operator presses the point of the hock in an upward and forward direction. After one limb has been adjusted the other must be dealt with in the same manner.

A still more troublesome and dangerous breech presentation is that where the hind-legs, instead of being flexed as in the case referred to above, are carried forward and downward towards the fore-limbs, and the thigh bent upon the pelvis allows the croup and buttocks to be presented (fig. 553).

Unless this misplacement is promptly recognized and corrected, the

difficulty will be aggravated by the straining, which, while forcing the breech backward into the pelvis, causes the hind-limbs to be moved farther forward at the same time, thus adding to the already serious difficulty of the case. Here "the rational indication is, of course, to extend the limbs of the fœtus backwards, as in ordinary breech presentation (fig. 551), and to give these and the body a direction in harmony with the axis and dimensions of the pelvic inlet, so that birth may be effected by the combined efforts of the mother and the obstetrist". But this indication is often most difficult to fulfil, though in some instances it is possible when labour is not too advanced, and when the fœtus, still in the abdominal cavity, is movable, and can be pushed sufficiently from the inlet to allow the lower part of the limbs to be seized and brought into the vagina.

Pushing the fœtus as far into the abdomen as possible, one of the limbs is seized above the hock, and the thigh flexed as completely as circumstances will permit, by lifting that joint towards the mother's sacrum. Still pushing the fœtus off by means of the repeller or crutch, the hand is passed down to the hoof until the toe is reached and enclosed in the palm; by adopting this precaution danger of injury to the uterus or vagina is averted. Then the foot is brought into the passage by flexing all the joints on each other. Again, pushing the fœtus forward, the same manœuvre is repeated with the other limb, if necessary, and delivery is proceeded with.

MALPOSITION OF THE HEAD

Neck Presented, Two Fore-Limbs in the Passage.—The difficulty in bringing about a natural presentation in this case will be in proportion to the backward displacement of the head.

Should this be slight, it may only require that the hand be passed under the chin or into the mouth, and the head raised into the passage. Where, however, the neck is much bent, and the head carried under the brisket with the poll firmly fixed against the pelvic brim (fig. 554), considerable difficulty will be experienced in restoring the parts to their proper position.

The first requirement will be to push the body backwards by means of a powerful arm, or failing in this, crutches applied to the front of the shoulders. By doing this, room will be provided for the forward movement of the head. An attempt must now be made to raise the latter by seizing such parts as come within reach to which traction may be applied. The ears will be first accessible, or blunt hooks (fig. 557) may be inserted into the orbits, or passed behind the lower jaw or into the angle of the

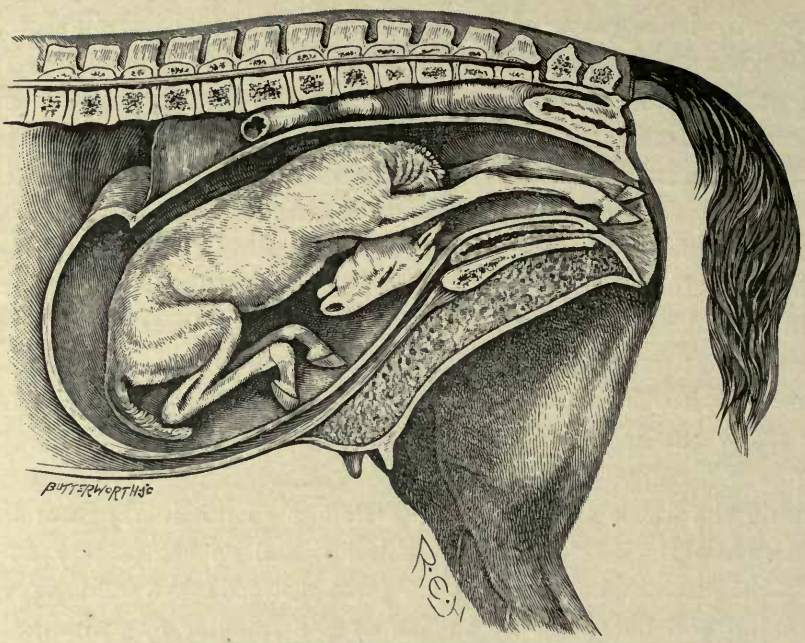


Fig. 554.—Neck presented, Fore-limbs in Passage

mouth. It is necessary to point out that in order to obtain the full benefit of the measures suggested above, the backward force should be

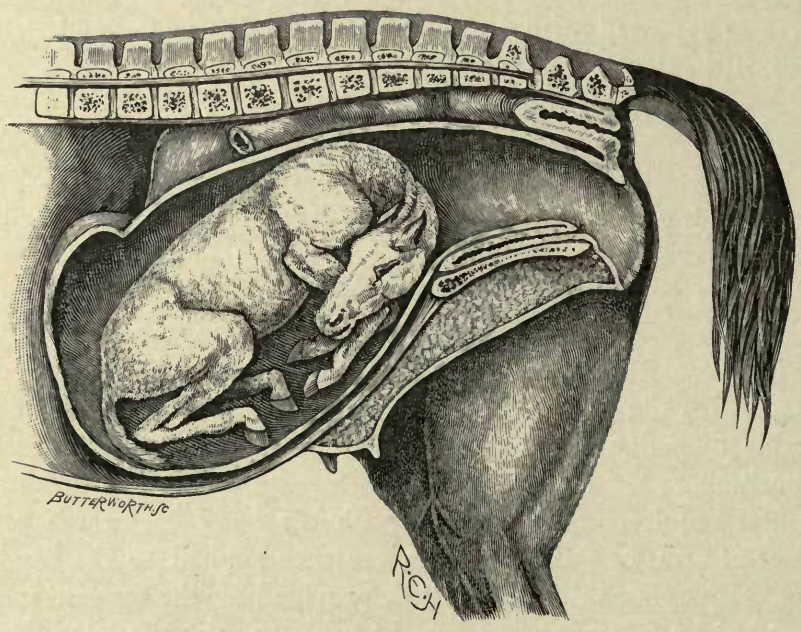


Fig. 555.—Neck presented, Legs directed backwards

applied to the body at the same time as the forward pull is made upon the head.

Breast Presented, Legs in the Passage.—The head may also be displaced laterally, *i.e.* thrown back on to the right or left side of the neck or body. Here again the degree of displacement will vary in different cases. Sometimes the head is merely flexed on the neck, while in others the neck is bent backward and may carry the head as far as the flank (fig. 556). The long neck of the foal tends to render these presentations difficult and sometimes impossible to rectify. On the mode of procedure in these cases the late Dr. Fleming observes: "The principal aim is, of course, to get hold of the head, adjust it, bring it into a favourable position in the

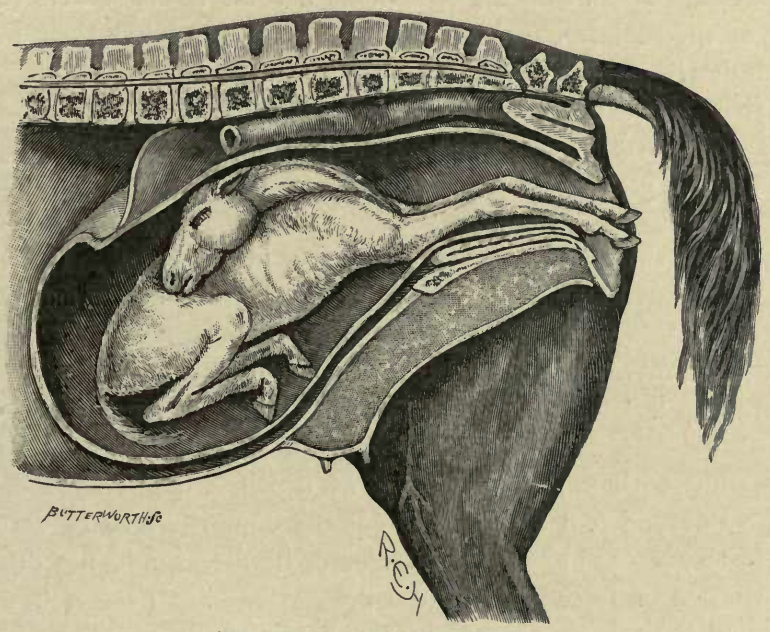


Fig. 556.—Legs and Breast presented

genital canal, and then terminate delivery. With regard to adjustment the better plan appears to be as follows:—Cord the presenting fore-feet, push the fœtus into the uterus so as to clear it from the pelvic inlet, pushing either on the flexed neck or chest, and not directly backward, but rather obliquely to the side opposite that to which the head inclines, so as to bring this round to the inlet. If the fore-limbs are in the way of the operator they may also be pushed back into the uterus." The head should then be sought for and brought into position.

Here the ears are the most accessible parts to which force may be applied; then, if necessary, blunt hooks may be inserted into the orbits, or into the angles of the mouth, and the head drawn forwards by means of cords, while the body is being pushed backwards with a crutch or repeller. When the head has been brought into line with the body,

delivery is then effected in the usual way. Besides this faulty position the head may also be thrown upwards and backwards while the fore-limbs are presented in the passage. As we have already pointed out, these are always most difficult tasks, and require a large practical experience, skill, and judgment to ensure success. They are not such as to be undertaken by the amateur if professional assistance can be procured.

MECHANICAL AIDS TO DELIVERY

Mechanical aids in difficult operations become indispensable to success, and it is of the first importance that whoever undertakes their use should clearly understand the particular purpose for which they are designed, as also their most effective mode of adjustment. These qualifications cannot be imparted by any written description, but must be acquired by experience and practice.

In proceeding to deliver a mare, the uterus should first be freely explored until the precise position of the fœtus has been determined; then the steps necessary to bring it into a natural presentation and effect its removal should be carefully considered.

In this connection it should always be in the mind of the operator that where two feet are presented they may not belong to the same animal, and before delivery is attempted he should fully satisfy himself that he is not dealing with twins, from each of which a foot may proceed.

Where but one foal exists, it is equally important to be assured that the feet in the passage are both fore-feet or hind-feet, and not one of each. The application of force while these precautions are neglected would endanger the life of both dam and offspring.

It may be found that the existing malposition is such as can be rectified by a little judicious employment of the hands alone, or that the use of ropes, repellers, hooks, or pulleys, or all these several appliances, will be called for in the course of delivery. Besides the mechanical aids, it must not be overlooked that the mare may be made to lend herself to the process of delivery by being placed in certain special positions. By raising the hind-quarters with litter, the fœtus may be thrown forward and more room afforded the operator in rectifying the presentation, or it may be desirable to place her in the reverse position by underpacking in front.

It is a good working rule to secure with ropes or other means all parts which are found to be in the passage whatever they may be, and to keep them under control until it has been fully decided that they are not necessary to delivery.

Many parts of the body of the fœtus are available for the application of ropes and other instruments, by and through which to bring traction to bear upon the fœtus.

A stop-noose may be applied round the neck, a light head-stall extemporized out of a strong cord may be fitted to the head. A running noose passed into the mouth and carried over the poll, or applied round the lower jaw, will aid materially in the application of force, and the same may be said of ropes applied above the hock or knee, or the fetlock, or the foot.

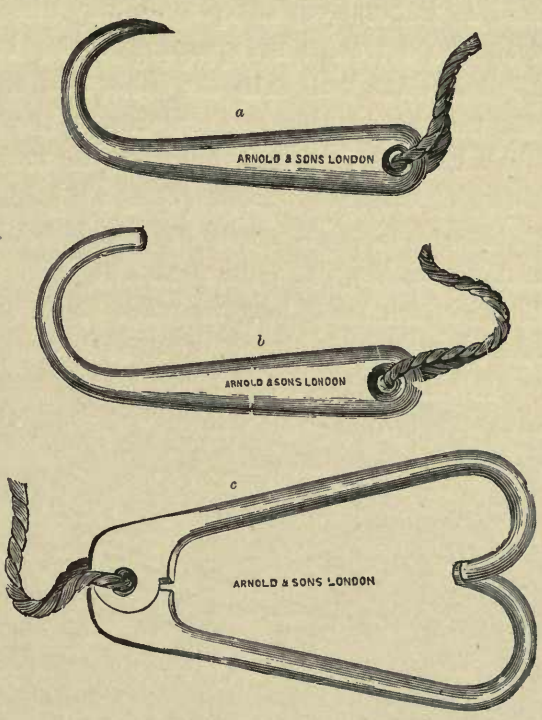


Fig. 557.—Hooks or Crotchets

a, Sharp; *b*, blunt; *c*, double.

When no sufficient hold can be secured by these means, hooks of various descriptions may be brought into use; but it must be understood that, while in trained hands they are most useful auxiliaries, in the hands of the unskilled they may prove dangerous and even deadly instruments. Hooks or crotchets may be sharp or blunt, single or double (figs. 557). Some are attached to ropes, and others are fixed to handles. The crutch or repeller (fig. 558)

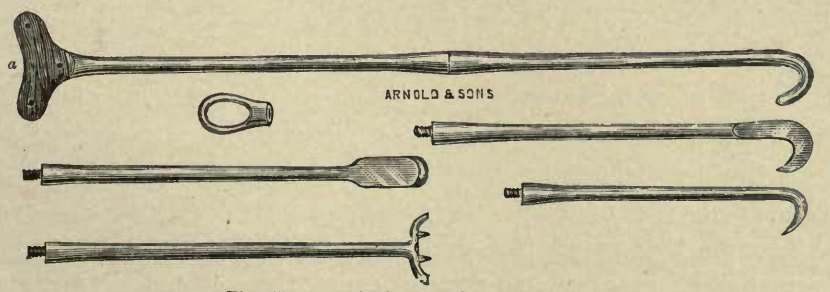


Fig. 558.—Gowing's Parturition Instrument

a, Crutch or repeller.

is another means of moving the body of the foal backwards into the womb when it is desired to make room for securing and changing the position of one or more of the extremities. Blunt hooks connected with a rod will be found useful to anchor on to the angle of the mouth or

the orbit of the eye, when these parts are placed beyond the reach of the hand, and in critical cases, when the mare is in danger and a firm hold is imperative, sharp ones may also be made available in connection with the latter. In applying them, however, care should be taken to implant them well into the orbit, and to avoid the use of excessive force, lest we should tear out and injure the walls of the uterus.

When no sufficient hold can be secured by any other means, double hooks or crotchet forceps (figs. 559), blunt or pointed, may be employed.

Double crotchets will be found serviceable in a variety of conditions, and especially when no sufficient hold can be secured by other means. These instruments may be made to enter the tissues and take a firm hold of deep-seated tendons or ligaments, or be anchored on to bones.

In employing these several aids to delivery it should be understood that everything which it may be found necessary to introduce into the

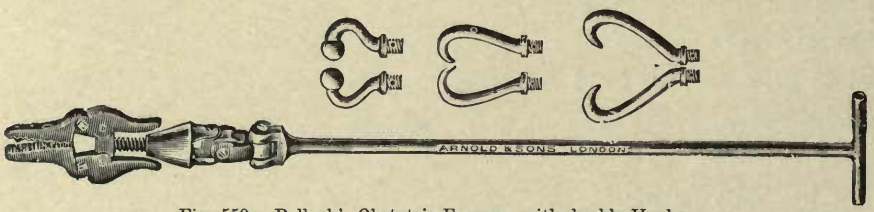


Fig. 559.—Pollock's Obstetric Forceps, with double Hooks

uterus or genital passage should be thoroughly clean and disinfected, and the same precaution also applies to the hands of the operator, whose nails should be cut short as a safeguard against injury to the womb.

APPLICATION OF FORCE IN DELIVERY

When force is employed in the removal of the fœtus it should be steady, regular, and continuous. Jerky and spasmodic traction avails but little, and may be actually injurious both to the dam and offspring. The effort, when commenced, should be sustained, and increased steadily with each throe or labour pain, so that the outward force and the inward force shall continue and operate simultaneously. Until the head has passed through the vulva the pull should be directly backwards, then slightly inclined downwards so as to prevent the withers jamming against the upper boundary of the pelvic outlet. As the shoulders pass through the pelvic outlet the resistance will be very considerably increased. To overcome it a pull should be taken slightly to one side and then to the other, and the same alternation of movement may be practised when the hips drag in the passage.

Where the case is protracted and signs of exhaustion appear in the

mare, the efforts must be sustained by the administration of stimulants and a short rest. The necessity for this may be frequently avoided where plenty of force is provided early, while the mare is fresh and full of energy. Many mares are annually sacrificed from neglect of this precaution, and veterinary surgeons rightly complain that delivery is frequently rendered impossible, and the life of the mare jeopardized by the "pulling about" she suffers, for want of sufficient well-directed force at the outset.

CARE OF MARE AND FOAL AFTER PARTURITION

After parturition, and if mare and foal are getting on well, warmth, comfort, cleanliness, and a plentiful supply of good food are all that are necessary while they are under cover. The most favourable, and therefore the most natural, time for mares to foal in is during the months of March, April, and May, when the weather is, or should be, propitious and grass is plentiful. At this period, if the mare has been pastured before foaling, she and the foal may soon be allowed out of the loose-box to the paddock if the weather be fine, as nothing can be more invigorating for both than a run at grass, if only for an hour or two at first, though they must on no account be exposed to rain or cold winds if such exposure can possibly be avoided.

In the loose-box, good hay and a small allowance of crushed oats two or three times a day should be given; and if grass is not available, and especially if the mare does not furnish a sufficient supply of milk, mashes of boiled barley or oats, to which coarse sugar or treacle has been added, may be allowed frequently, and with great advantage. Crushed oats is especially to be recommended for the mare when the foal is a few weeks old, as the foal begins to nibble at and soon to eat them, and thus to prepare itself in the best way for being weaned, while this addition to its food will greatly tend to its robustness and development.

The foal itself is not liable to many diseases if properly cared for. At birth the attendant should give it his immediate attention if it does not immediately breathe, as unless he then acts promptly it may die. When it fails to inspire after the navel-string has been divided, he should at once open its mouth, seize the tongue, and pull it gently forwards a few times at some seconds interval, blowing hard into the mouth and nostrils while the tongue is forward. Flicking the sides of the chest with a wet towel at intervals may also produce the desired effect.

THE RATE OF GROWTH IN THE HORSE[1]

Some years ago certain naturalists were wont to maintain that plants and animals had reached their present stage of development through the operation of internal (innate) forces. Now, however, the belief is all but universal that organisms are what they are to-day because of the operation of external forces—that they have reached their present stage through the ever-present influence from generation to generation of the external surroundings or environment. If, during the past, the environment (which includes not only the food, temperature, and other like influences, but also the influence living things have on each other) has been the means of producing so marvellous results—of not only causing variation but also of playing the part of the selector,—it may be safely assumed that changes in the external conditions may even in a single lifetime lead to very decided modifications—not necessarily of a permanent (hereditary) kind—in, say, the size and fitness, the time at which maturity is reached, and more especially in the germ-cells from which the next generation springs.

That in the case of the horse the external conditions or environment count for something, a glance at the history of the *Equidæ* affords sufficient evidence. In early Eocene times the representatives of recent horses were small-brained, primitive, five-hoofed creatures, about the size of a wolf, but at the most semi-plantigrade. As age succeeded age the outer digits (1 and 5) gradually dwindled, and at length Hipparion appeared on the scene, a creature decidedly equine in form, and only essentially differing from the horse of to-day in its teeth and in its limbs, each limb bearing three complete hoofs, as in the rhinoceros.

At a still later period the evolution of the horse was carried a stage further by the shrinking within the skin of the second and fourth digits, already quite useless in Hipparion and in the three-toed horse (Protohippus) of the New World.

Like Hipparion (many fossils of which have been unearthed near Athens), the true horse, during at least the Reindeer period in Europe, was of a considerable size. This conclusion is supported by the size of the petrified remains in the Rhone valley, where for a time the horse afforded abundant sport for Palæolithic man. Just as in olden times the elephant in certain areas dwindled in size to form pigmies measuring sometimes only 36 inches, so the horse gradually dwindled to form certain pigmy breeds which (as in the Shetland Islands) were often as small as the little elephants that in olden times flourished in what is now the Island of Malta.

[1] By Professor Cossar Ewart in the *Live Stock Journal Almanac*.

In the case of the horse, as in the case of the elephant, the dwarfing was undoubtedly due to unfavourable surroundings. If the external conditions were sufficient in, geologically speaking, a comparatively short time to dwarf the horse until it was actually smaller than the "fossil horses" of the remote Eocene epoch, it is not surprising that man—with his wonderful control over nature—is able even in a single generation to modify greatly the horse and other domestic animals. That in a few centuries the large, highly-nervous race-horse, with his wonderful speed and courage, has been evolved out of Eastern and native ponies is a matter of history, and everybody knows that while some are now engaged in breeding pigmy horses little over 30 inches in height, others are as successfully breeding huge, powerful animals as wonderful in their way as their pigmy relatives. It may even be said that a recognized part of the breeder's work consists in modifying, through changes in the external conditions, the animals to which he happens to devote his special attention, just as horticulturists, by food, heat, and timely shelter, alter plants until all resemblance to their wild stock is as good as lost.

Breeders of Shetland and polo ponies, and, for that matter, breeders of race and heavy horses, know well enough that to have any chance of success they must exercise the utmost vigilance over the conditions under which their foals, colts, and fillies are reared. Hitherto, as far as I can learn, breeders have not had at their disposal any very accurate information as to the rate of growth of horses either during development or after birth, and hence, though aware that growth is rapid during the first year, they have been without any certain index as to when changes in the food, temperature, &c., are likely to produce the maximum effect.

Having for some years been collecting data bearing on the development and rate of growth of the horse, I propose now placing on record such facts as are likely to prove interesting and suggestive to breeders, and to lead, perchance, to the influence of various kinds of treatment before and after birth being systematically investigated. In studying the rate of growth of the horse, it is hardly necessary to point out that on the one hand allowance must be made for the influence of the external conditions, and on the other for hereditary influences, *i.e.* the stereotyped changes ultimately due to the environment. In other words, that in an investigation of this kind the surroundings should be as natural as possible, while the animals used should neither be characterized by an hereditary tendency to produce either very large or very small offspring. Bearing these points in mind, I selected for observation the offspring of horses from 14 hands to 14 hands 2 inches in height—the height at times reached by horses living in an almost wild state in the west of Ireland—and I provided the foals and

colts under observation with as natural surroundings as circumstances permitted.

Having fixed on the size of the horses to be studied, it was next necessary to consider how the rate of growth before and after birth could be best determined.

The difference between a tall and an undersized man is mainly a difference in the length of the legs; but in the case of the horse the height, as commonly understood, instead of bearing, as in man, an intimate relation with the length of the hind-limbs, is intimately related to the length of the fore-limbs.

The height of a horse, it is hardly necessary to state, depends mainly on (1) the length from the elbow to the ground; (2) the length and obliquity of the arm-bone (*humerus*); and (3) the length of certain spines of the dorsal vertebræ, the spines which give rise to the more or less arched ridge known as the withers.[1]

In the living animal it is impossible to measure the length of the vertebral spines, and only possible to estimate roughly the length and obliquity of the humerus, and hence it will be necessary in studying the rate of growth in the horse to trust chiefly to the length of the fore-limb as measured from the elbow to the ground. In man the limbs belong to the common or ordinary vertebrate type, but in the horse they have departed as far from the general plan as highly useful structures well could, for instead of five digits, as in man, there is but one complete digit, and in their hard parts the limbs are infinitely more highly specialized than is the case in any other mammal, and more profoundly altered than even the wing of a bat.

Influenced by the doctrine of recapitulation (the belief that each animal climbs its own ancestral tree), not a few were wont to believe that when a sufficiently young horse embryo was examined, the fore-limbs at least, as in the early Eocene "fossil horses", would be pentadactylous, *i.e.* have rudiments of five digits. This, however, is not the case; at no stage in the development (in the life-history as distinguished from the ancestral history) of the horse are there any visible rudiments or vestiges of the first and fifth digits. In other words, the horse is at the most tridactylous, and only one of the digits—the one corresponding to the human middle finger in front and the human middle toe behind—ever comes into use.

In the case of the horse, the first rudiments of limbs appear in the form of short bud-like outgrowths between the twenty-first and twenty-eighth

[1] Than the height at the withers it would be difficult to find a less trustworthy index of the size of a horse. The height at the elbow is a safer guide, or, seeing that a horse (like a man) propels itself by the hind-limbs, the height at the croup should be taken into consideration.

days. The growth is at the outset so deliberate that even at the end of the fifth week the limb rudiments (fig. 560) are only 2 mm. (about $\frac{1}{5}$ inch) in length. After a time, however, the rate of growth is accelerated, with the result that before the middle of gestation (the twenty-fourth week) is reached they are relatively as large as in the full-grown horse. Having reached this size, it might be assumed that they would continue to maintain the same proportions up to the time of birth. This assumption would, however, be wide of the mark, and in fact would never be made by anyone aware of the great relative length of the legs in the new-born foal (fig. 561). To have a chance of surviving in a wild state—of escaping prowling wolves or hungry hyænas, jackals, and hunting dogs—a foal must almost from the moment of its appearance on the scene be capable of keeping up with the troop into which it is so unceremoniously introduced—sometimes apparently to the annoyance of the ever-watchful leader and head of the family.[1] To succeed in this it requires legs long enough to gallop at least as fast as the older members of the herd. It is doubtless for this reason that during the second half of the period of gestation the limbs grow very much faster than the trunk, with the result that for some weeks before birth they are relatively not only extremely long, but so wonderfully perfect in all their parts that, as in certain other wild ungulates, a foal is no sooner ushered into the world than it is galloping merrily along, carefully shadowed by its dam.

Fig. 560.—Horse Embryo (five weeks)

[1] Stallions in a wild state sometimes endeavour to compel mares to leave their foals; thus all the more ensuring that only vigorous offspring survive.

The smallest horse embryo in my collection measures 7 mm.—just over $\frac{1}{4}$ inch. This, a twenty or at the most twenty-one days embryo, is somewhat fish-like in form, but quite limbless. Soon after the end of the third week limbs appear in the form of minute buds. At the end of the fourth week (fig. 562) they are easily recognized, and by the end of the fifth week they are 2 mm. in length; at the end of the fourth week a horse

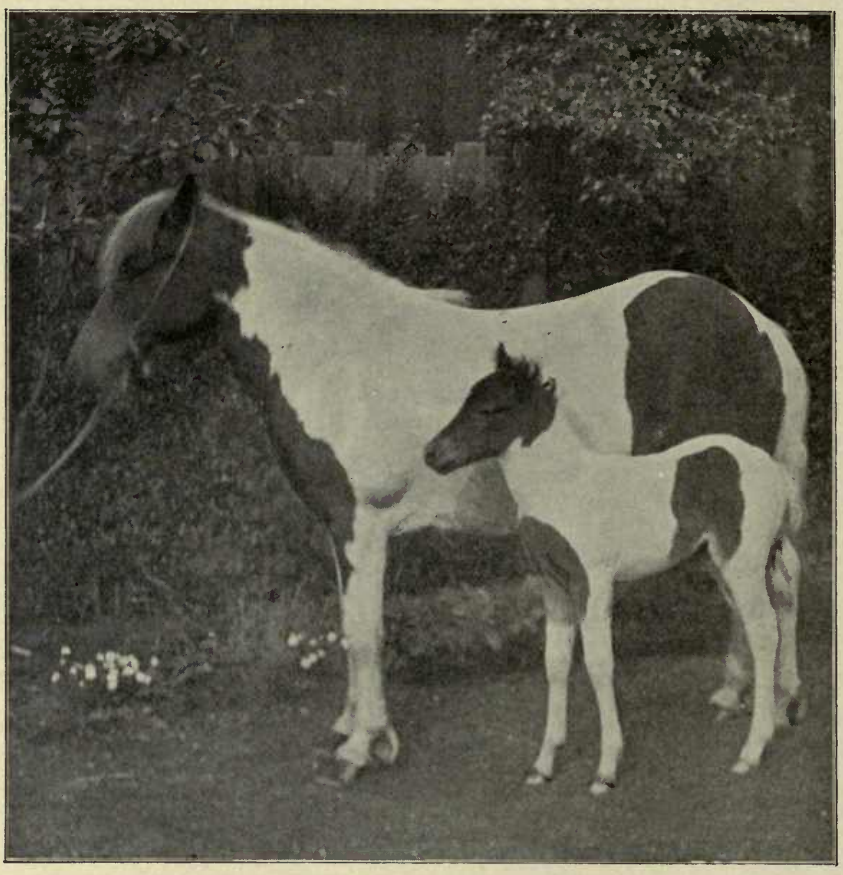


Fig. 561.—Mare and New-born Foal

embryo measures 10 mm., and is not unlike a human embryo of the same age; by the end of the fifth week it is 5–6 mm. longer. At first the limb buds are simple paddle-like, structureless outgrowths, but during the fifth week rudiments of the skeleton appear; while during the sixth week they are so rotated and flexed that the position of the elbow and wrist (commonly called the "knee") can be made out in the fore-limb, and in both fore- and hind-limb there are indications of three digits (2–4). Even at the end of the sixth week, when the embryo is 2 cm. in length, the fore-limbs only measure 4 mm., and the hind-limbs are but little longer (fig.

563). Marked progress is made during the seventh week, with the result that before the eighth week is reached the limbs have all the distinctive equine characters and are about one-third of the total length of the embryo —the embryo measuring 3 cm., the limbs nearly 1 cm. Before the eighth week is reached not only are the elbow and "knee" evident, but the fetlock

Fig. 562.—Hind Limbs and Tail (four weeks)

Fig. 563.—Hind Limbs and Tail (six weeks)

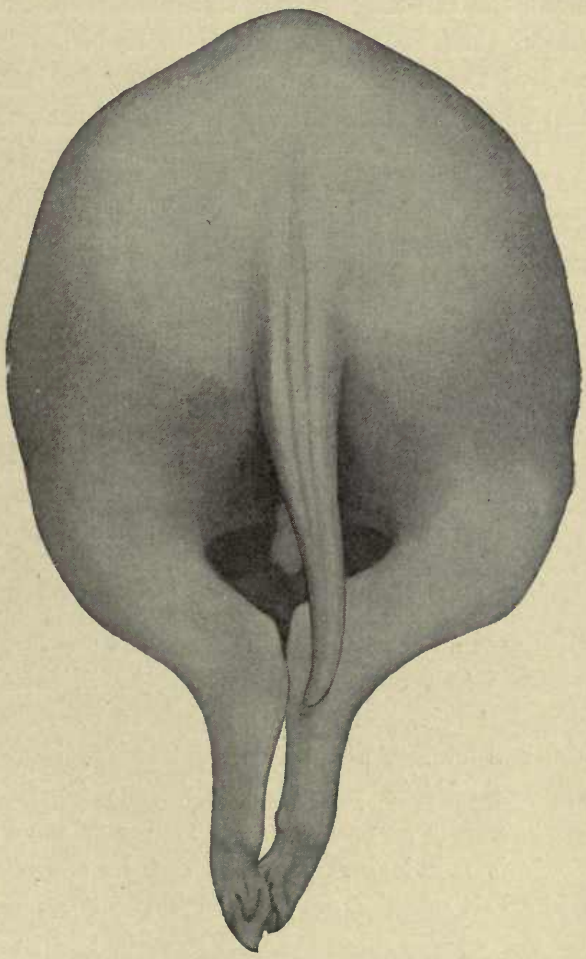


Fig. 564.—Hind Limbs and Tail (eight weeks)

and frog of both fore- and hind-limbs are fairly well moulded, and in the latter the true knee (stifle) and hock are well defined (fig. 564), the distance from the hock to the tip of the developing hoof being 7 mm. By the end of the eighth week we have a horse in miniature. At this stage (the total length of the embryo being 6·5 cm.) the distance from the withers to the tip of the curved and pointed hoof is 3·3 cm., from the elbow 1·9 cm., while the length from the hock is 1·3 cm.

In figs. 562, 563, and 564 the growth of the hind-limbs and tail from

the fourth to the end of the eighth week is represented—five times natural size. It will be observed that as the limbs increase in length and complexity the tail gets relatively shorter. In the Eocene "fossil horses" the tail, at first long enough to trail on the ground, gradually dwindled as the heels (hocks) were raised. In becoming relatively shorter during development the tail may be said to repeat the ancestral history. It may here be added that up to near the time of birth there are only long hairs at the end of the tail, from which it may be inferred that in the Miocene ancestors of the horse the tail resembled that of the living asses and zebras.

During the eighth week the embryo nearly doubles its length, but during the three following weeks there is an increase in bulk rather than in length. At the end of the eleventh week the total length is 10·2 cm., the length from the elbow being 3·15 cm., from the withers 5·2 cm., and from the hock 2·4 cm.

From the eleventh to the fifteenth week the embryo again more than doubles its length, and increases considerably in weight. At the end of the fifteenth week the length is 23 cm., the height at withers 14 cm., the length from the elbow 8·8 cm., and from the hock 6·6 cm. Again, from the fifteenth to the twenty-fourth week the total length is nearly doubled, while the length of the limbs is more than doubled. At the beginning of the twentieth week the total length is 28 cm., the height at the withers 19·5 cm., the length from the elbow 12·3 cm., and from the hock 9·2 cm. By the time the twenty-fifth week is reached the total length of the young horse is 43·5 cm., the height at the withers 32·5 cm., the length from the elbow 21 cm., and from the hock 15 cm., the circumference below the knee being 3 cm. As already mentioned, before the middle of gestation is approached—*i.e.* prior to the twenty-fourth week—the bones of the limbs are as nearly as possible of the same relative length as in the adult.

This fact is best brought out by comparing the limb bones of a five-and-a-half-months embryo with the corresponding structures in the adult. In the thoroughbred horse Hermit the humerus measured 33·5 cm., the radius 37·5 cm., and the third metacarpal 25·5 cm. In a twenty-three-weeks embryo the humerus is 6·5 cm. in length, and the radius 7·3 cm.—*i.e.* the radius bears exactly the same relation to the humerus as in the case of Hermit. Again, the middle (III) metacarpal in a half-time embryo, to agree with the corresponding bone in Hermit, should measure 5·0 cm.; its actual length is 5·5 cm., *i.e.* it is already 5 mm. relatively longer than in Hermit; but this is more than counterbalanced in the twenty-three-weeks embryo by the phalanges being relatively shorter. In figs. 565 and 566 the bones of the fore-limb of a twenty-three-weeks fœtus, the radius and third metacarpal bear nearly the same relation to the humerus as in

Hermit. From the twenty-fourth week onwards the limbs grow faster than the trunk. In front the increase in growth is mainly beyond the wrist-joint, while in the hind-limb it is chiefly beyond the knee-joint or stifle. In both fore- and hind-limbs the increase is greatest for some time in the middle metacarpals (fig. 565, III) and metatarsals—*i.e.* in the fore and hind cannon bones. In the case of Hermit[1] (the 1867 Derby winner), when the humerus is taken as equal to 100, the third metacarpal is equal to 76·1. In a seven-months fœtus, however, with the humerus equal to 100, the third metacarpal may be over 90, while at nine months it may be over 110, and at birth 130—*i.e.* relatively well-nigh twice the length of the third metacarpal in Hermit. A similar rate of growth characterizes the third metatarsal bone. This increase in the cannon bones during the second half of the period of gestation explains to a large extent the great length of the foal's legs at birth; it also accounts for the fact that the cannon bones—the bones considered of so immense importance in all kinds of horses—increase but little in length after birth. In the case of a thoroughbred, *e.g.*, the third metacarpal appears only to increase 3 cm. (barely $1\frac{1}{4}$ inch) after birth,[2] while the main bone of the fore-arm (the *radius*) often increases 9 cm. ($3\frac{1}{2}$ inches), or nearly three times as much as the front cannon bone.

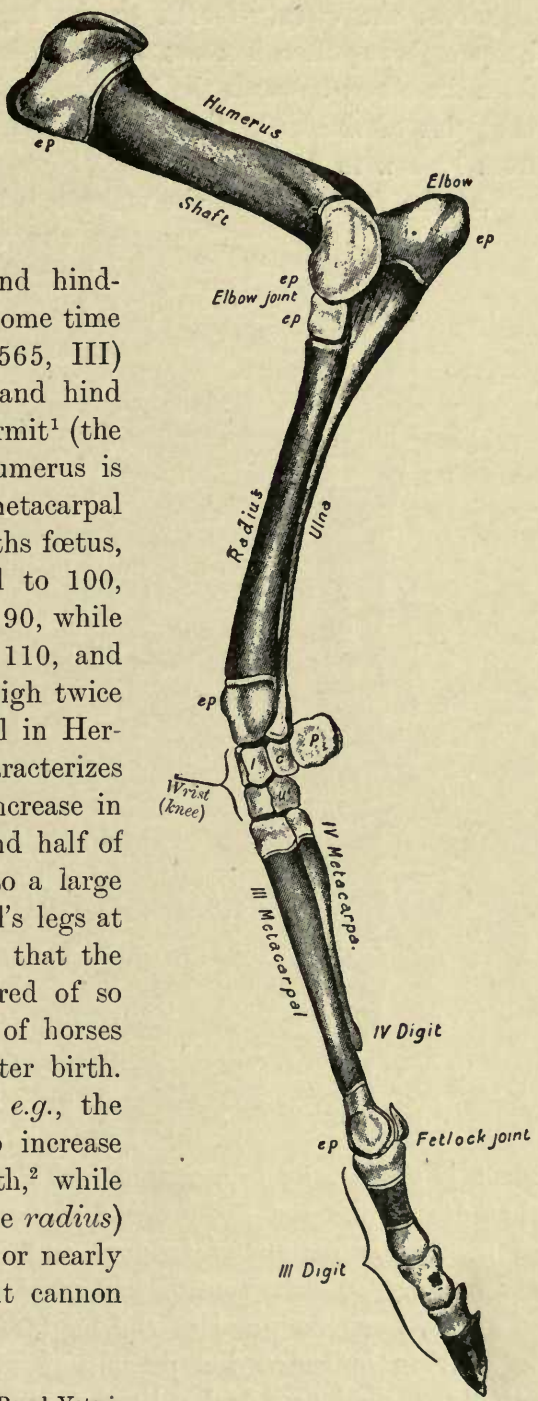


Fig. 565.—Fore-limb (twenty-three weeks), natural size

[1] The skeleton of Hermit is preserved in the Royal Veterinary College Museum, Camden Town, London. Eclipse's skeleton is in the Royal College of Veterinary Surgeons Museum, Red Lion Square, London.

[2] Though the cannon bones may only increase 1 inch in length after birth, they may increase 3 or even 4 inches in circumference in a 14-hands horse.

From the twenty-fourth to the beginning of the thirty-fourth week, horse embryos often increase at the withers from 32·5 cm. to 54 cm., while from the elbow onwards the increase is from 21 cm. to 34·5 cm., and from the point of the hock to the tip of the hoof the increase is 10·5 cm.—*i.e.* from 15 cm. to 25·5 cm.

At the fortieth week the embryo is about 86 cm. in length, the height at the withers being 76 cm.; from the elbow to the point of the hoof the distance is 52–53 cm., and from the hock 40–42 cm.

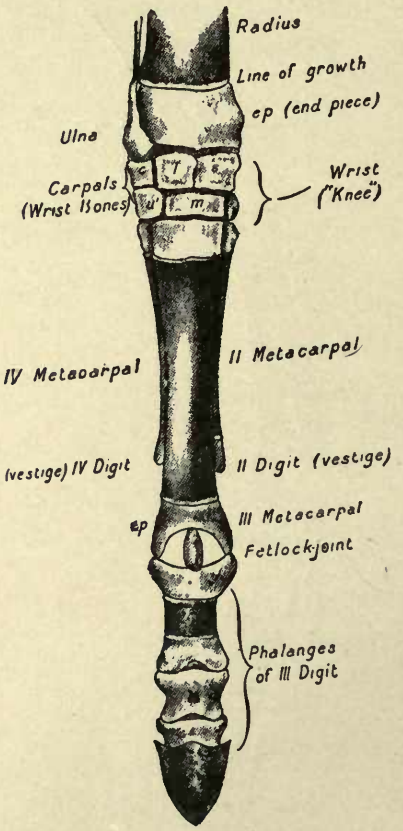


Fig. 566.—Fore-limb (twenty-three weeks), front view, natural size

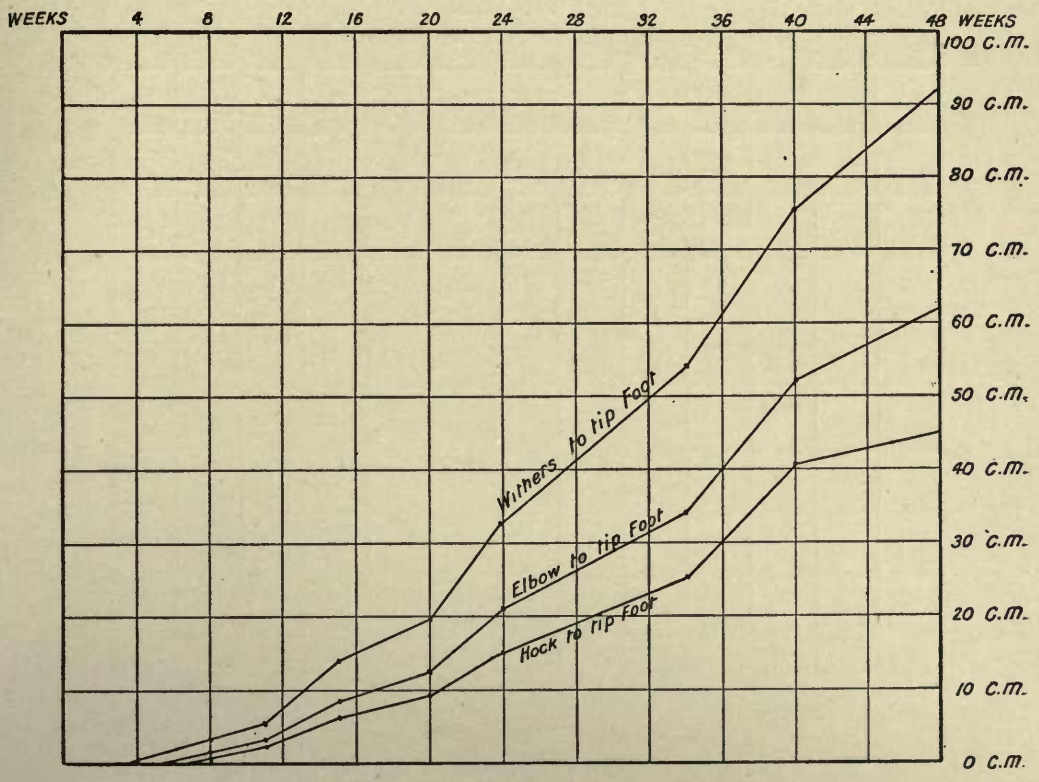
Of the 22 cm. of increase in height from the thirty-fourth to the beginning of the fortieth week, 19 cm. is due to the lengthening of the leg from the elbow downwards; but during the last eight weeks (*i.e.* 40–48) of fœtal life there is only an increase of about 9 cm. from the elbow to the ground, while the total increase at the withers is over 20 cm.

At birth the foal of 14-hands parents may be expected to measure 92 cm. at the withers, 62 cm. from the point of the elbow, and 45 cm. from the point of the hock to the ground, the circumference below the knee being 10 cm.

From these figures it appears that during development the actual increase in the length of the limbs is greatest between the twenty-fourth and fortieth weeks. The rate of growth at the withers and from the elbow and hock downwards during development is graphically represented in Table I. Further enquiries may show that during the last eight weeks of fœtal life there is a rapid formation of bone, a hardening of tendons and ligaments, and a strengthening of the muscles, so that immediately after birth the foal may, even in times of stress, keep its place in the herd.

Having indicated the periods at which the unborn foal grows most rapidly, I shall now deal with the rate of growth after birth. My observations show that the rate of growth of the foal is decidedly unequal even during the first three months. It might have been assumed either that the increase would be continuous and equal during the first two or three years,

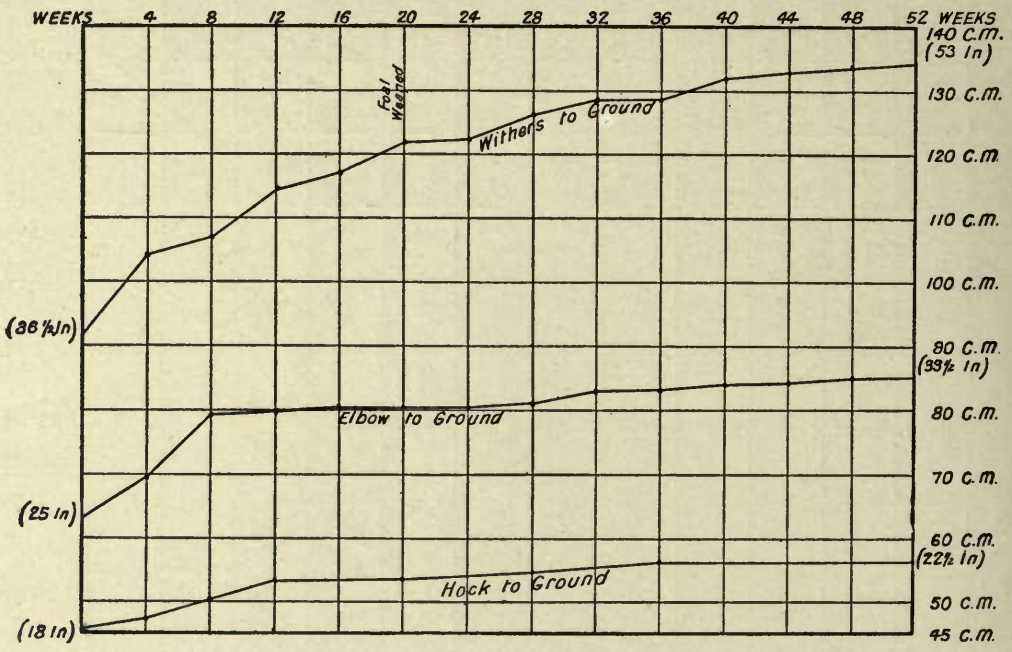
TABLE I.—SHOWING RATE OF GROWTH OF A 14-HANDS HORSE DURING DEVELOPMENT



or that, rapid at first, it would gradually diminish as the growth power of the bones was lost. From the data already collected it appears that the growth, rapid during the first month, is inconsiderable during the second, but more pronounced during the third, while from the fifth month onwards the rate of growth may be said to diminish gradually, there being, however, ups and downs, related to the shedding of the coat, weaning, or other disturbing causes. In Tables II and III I have indicated the rate of growth that may be expected in a colt (born early in May and weaned in October) that will eventually measure 56 to 58 inches at the withers.

During the first month the growth at the withers is 11·4 cm., during the second 3 cm., and during the third 10 cm. Throughout the second three months (4 to 6 inclusive) the growth at the withers is about the same as during the third month; from the seventh to the ninth month it is 6 cm., from the tenth to the twelfth 5 cm. Hence, during the first year the total increase in height at the withers may be all but 42 cm. ($16\frac{1}{2}$ inches). During the entire second year the growth may not exceed 8 cm. ($3\frac{1}{4}$ inches), and during the third year it may amount to less than an inch.

TABLE II.—SHOWING THE RATE OF GROWTH OF A 14-HANDS HORSE DURING THE FIRST YEAR



After the third year increase in height, if there is any, results almost entirely from a further lengthening of the vertebral spines that form the skeleton of the withers—the length of these spines is intimately related to the size and weight of the head. In the male wapiti, *e.g.*, the spines are long; in the female, owing to the absence of horns, the head is lighter and withers are absent.

Of the increase of height during the first six months 17·7 cm. are due to the growth of the fore-limb from the point of the elbow downwards, but during the second six months the increase of the fore-arm, wrist, and foot is only 3·7 cm., and after the first year the fore-limb from the elbow downwards only increases 1·4 cm. It is worthy of note that almost the entire increase in the length of the fore-limb below the elbow is due to the growth of the radius (fig. 565). The circumference below the knee increases considerably during the first three months, but alters little during the rest of the first year. In the case of the hind-limb there is a gradual increase from the point of the hock during the first nine months, when the maximum length is often reached—the increase is mainly due to a lengthening of the phalanges and the heel process of the os calcis, not to the middle metatarsal.

TABLE III.—SHOWING RATE OF GROWTH IN A HORSE DURING THE FIRST THREE YEARS

Age.	Height at Withers.	Height at Croup.	Girth.	Length from top of Head to line between upper margin of Nostrils.	Length from inner corner of Eye to upper margin of Nostril.	Length from point of Elbow to ground, the Leg occupying a vertical position.	Length from point of Hock to ground, the Shank having a vertical position.	Circumference below Knee.
	In.	In.	In.	In.	In.	In.	In.	In.
At birth	36½	38	30	12¼	5½	25	18	4¼
End of 1 month ...	41	42½	38½	14	6¼	27½	19	4¾
„ 2 „ ...	42⅛	44⅞	42	15¼	7	30⅞	20⅛	5¼
„ 3 „ ...	45⅛	46¾	46	15⅞	7¼	30¼	21¼	5¾
„ 4 „ ...	46¾	48¾	48	17⅛	7½	31⅝	21¼	5¾
„ 5 „ ...	48	49	49½	17⅛	8	31⅝	21¼	5¾
„ 6 „ ...	48⅛	49⅜	52	17½	8¼	31¾	21½	6
„ 7 „ ...	49¾	51¼	53½	17¾	8⅜	32	21¾	6
„ 8 „ ...	50½	52	54	18	8½	32¾	22⅛	6
„ 9 „ ...	50⅝	53¼	56	18¼	9	33	22½	6
„ 10 „ ...	51⅞	53⅜	56½	18½	9⅛	33	22½	6
„ 11 „ ...	52½	53¾	57¼	19	9½	33¼	22½	6⅛
„ 12 „ ...	53	54	59	19½	9¾	33½	22½	6¼
„ 24 „ ...	56¼	56½	64	20¼	10¼	33¾	22⅝	6¾
„ 36 „ ...	57	58	68	20½	10½	33¾	22½	7½

The length of the head gradually increases all through the first year, when the maximum length is nearly attained. The increase is mainly below the orbit, the space between the inner canthus of the eye and the upper margin of the nostril being nearly doubled during the first two years.

It will be noticed from Table III that the girth is all but doubled during the first year.

Why, it may be asked, is the growth in the horse arrested so much sooner than in man? In the horse, as in man, the majority of the long bones consist of a shaft and of two end-pieces (*epiphyses*) (fig. 566, shaft, ep., ep.). The increase in the length of the typical long bones takes place at the junction of the shaft with the epiphyses. This zone of growth is a source of weakness, and the sooner the terminal pieces—which by their free ends enter into the joints—firmly coalesce with the shaft the better. In the horse this fusion takes place at a comparatively early stage, and when it has been once effected all further increase in length becomes impossible.

The question may now be asked: Can any practical use be made of all this information as to the rate of growth in the horse?

To this question an affirmative answer may very safely be given. In England it is often taken for granted that the sire counts for infinitely more than the dam. If the sire happens to be more impressive than the

dam, he will doubless count for most in the characteristics of the offspring; but a sire, however good, can no more make up for want of quality in the dam than good seed can yield a good return regardless of the nature of the soil in which it is sown. To begin with, it is quite as important that the germ cell provided by the dam should be as perfect in every respect as the infinitely smaller sperm cell supplied by the sire. Further, unless before development begins there is stored up an abundant supply of the material needed for the developing embryo, and unless all through the period of gestation the food contains the ingredients requisite for building up the bones and other tissues of the developing foal, the result must of necessity prove disappointing. However perfect the sire, he can no more assist in providing nourishment or suitable conditions during development than he can assist in ministering to the wants of the foal after birth.

But the enquiry as to the rate of growth of the foal mainly shows that from the sixth week of development there is an ever-increasing demand for bone-forming material. This demand, great enough during the later months of gestation, is especially urgent during the first three months after birth; I might almost say during the first five months, for it is during this period that the growth of the bones mainly takes place. It may hence be said that, with the help of the information submitted, the breeder should be better able so to regulate the food of his brood mares that an abundant supply of bone-forming material will be available not only during, but for some months after, gestation, and will be in a position so to treat his colts during their first two years that they may reach either a maximum, an average, or a small size, and, whatever the size, will be provided with the best possible chance of forming large ivory-like bones, and, what is perhaps of equal importance, strong ligaments and tendons capable of withstanding sudden jars and strains.

HORSE TRAINING

SECTION VII.—HORSE TRAINING

THE GENERAL TRAINING AND PREPARING OF HORSES

Until a person has by practical experience become acquainted with the evil results of bad breaking, it is impossible for him to estimate the importance which attaches to the proper handling and preparing of horses for whatever their future mission in life may be. Of course, as different varieties of horses have to be put to different work, and as tempers and constitutions vary very considerably, each class of animal has to be treated separately in matters of detail, though up to a certain point there is a similarity in the methods applied to the breaking and preparation of all horses.

Individuality.—Thus, for instance, the man who is entrusted with the responsibility of preparing a horse for whatever purpose will, if he is wise, endeavour in the first instance to master all the details of the temper, constitution, and peculiarities of the animal. He will satisfy himself of the condition of the teeth, digestion, wind, eyes, limbs, and general state of his pupil, and will use his best endeavours to strengthen any weaknesses which may exist in these before the preparation commences, or, if possible, so to shape his system that it will adapt itself to the peculiar infirmity of that particular horse. Any inattention to such preliminary considerations as the above will be certain to be associated with failure and disappointment, as it cannot be too strongly impressed upon all those who have transactions with horses that no two animals are identical in all respects, and therefore that a course of treatment which will prove beneficial to one may prove worse than useless if applied to another.

Whip and Bit.—The great mistakes which many persons make in breaking, schooling, or preparing horses are the over-application of the whip and the adoption of a loud bullying tone towards the animal when he makes a mistake, or does not immediately respond to the requirements of the breaker. Even the Duke of Newcastle, in his sumptuously illustrated folio work on equitation which was published so far back as the

year 1743, expressed himself very strongly upon this subject. In attending to the whip, he says "it is oftentimes of service, but I wish it were more sparingly used", and assuredly these words of wisdom should be written in letters of gold in every saddle-room in the kingdom. There is, too, a very general tendency towards the employment of unsuitable bits on horses of all varieties, young and old, light and heavy, and upon this point again the old Duke of Newcastle is to be credited with the delivery of most excellent advice. He writes: "But, above all, this rule is chiefly to be observed, to put as little iron in your horses' mouths as possibly you can". This advice is so admirable that it needs no comment, and may be sincerely commended to all horse-owners in the present day. Overbitting, unnecessary flogging, and the intimidation of nervous horses by the shouting and bullying of loud-voiced trainers are indeed most fruitful causes of inglorious displays in public on the part of animals which, had they been properly treated, would have rendered far better accounts of themselves. Therefore the most scrupulous attention to their comfort and well-being in other respects will certainly be neutralized if the natural tenderness of their mouths and their individual peculiarities are not also most carefully considered.

Training for Hard Work.—In training and preparing horses for hard work it is perhaps unnecessary to state that the methods which obtained in days gone by have been greatly modified in many respects; but even nowadays considerable difference of opinion exists amongst trainers as to what is beneficial and what is not good for a horse. Some men are keen believers in a system which involves an almost merciless amount of hard work being set any animal which can endure it, whilst others advocate a life of comparative laziness for the aspirants for future honours, both parties being more or less indifferent to the fact that, after all, the individual temperament and strength of each horse should be considered by itself, and every case be permitted to stand on its own merits.

Water.—Most probably, however, the views of trainers differ more strongly from each other upon the subject of water than they do upon any other point. In America it is not generally considered necessary to restrict the supply of fluid to any very appreciable extent, and great was the astonishment of English race-goers when they first saw the American race-horses indulged with a drink from a pail of water before proceeding to the post to fulfil their engagements at Newmarket. Mr. John Splan, one of the most successful trainers and drivers of trotting horses, is emphatic in his opinion that plenty of water should be supplied the competitors in a match, as he writes that a drink may be given "before the race, in the race, after the race, or at any time the horse wants to drink"; but on the

other hand, he is not an advocate of a constant supply being always beside the animal in the stable.

Grooming.—A very important point in connection with the preparation of all horses is to secure the services of a thoroughly reliable and competent man to attend to the grooming and other details of stable management, as no one can possibly calculate the number of horses which have failed in their preparation in consequence of the carelessness of those who have them in charge. Proper grooming is, in short, only of secondary importance to food and exercise, and yet many an owner or trainer will trust a valuable animal to the care of an inexperienced lad, or an unsteady man, simply because the wages paid to such people are lower than those demanded by a thoroughly competent groom.

The stable accommodation for horses in training should, of course, be warm, yet airy. The admission of a plentiful supply of fresh air is consequently a necessity, though, on the other hand, the presence of draughts will assuredly affect the well-being of the horse. In stating that the stable should be warm, it is not implied that the temperature should be unnaturally high, or that any approach to stuffiness should exist. If the ventilation be defective, so that the ingress of fresh and the egress of foul air is rendered impossible, the horses are pretty certain to suffer in their respiratory organs, and indeed in their general health and stamina. Avoid overclothing a horse in training; rather treat him as you would yourself, by giving him an extra rug when the night promises to be cold, and relieving him of a superfluity of woollen blankets when the weather is mild.

System.—Above all things, the person entrusted with the responsibility of preparing a horse, whether it be for work or show, should endeavour to act by system. It is his duty to make himself familiar with the peculiarities, constitutional and otherwise, of each individual animal, and to lay down the method of treatment for each. By adhering to the general regime he has determined upon he will soon discover whether it is adapted to any particular horse, and if it is not, he will be enabled so to modify it as to meet the requirements of the animal. On the other hand, if there is no method in force, the trainer cannot possibly tell in which respect his plans have failed, and the horse goes back in condition for the lack of that inspiration which the trainer vainly looks for in the dark.

Food.—Of course the best English oats and sweetest upland hay should form the staple food of all horses which are undergoing a preparation, the addition of clover, carrots, beans, and the like being regarded more in the light of adjuncts to the diet than as ordinary fare. For soft food many trainers prefer boiled oats to bran, which some ironically refer to as being as beneficial to a horse as saw-dust; and it is better to feed a horse four

times than three, adding a sufficiency of chaff to the corn to ensure his masticating the latter properly and not bolting it so that it will pass through him undigested. Never give hay at the same time as the corn, is a good rule to follow, else a gross feeder will be liable to gorge himself, whilst a shy doer's stomach will revolt at the sight of so much food.

Companionship.—Finally, it must be remembered that some horses pine if kept in an isolated box by themselves, and that such socially-dispositioned animals will therefore rest better if kept in a stable where they can see and hear other horses. Others fret and worry themselves if near their stable companions, and should therefore be kept apart, as it is of the highest importance to the well-being of all horses in training that their long hours in the stable should be passed as comfortably as possible.

The above are perhaps the most important of the general rules which should be attended to by the amateur who is desirous of getting his animal fit; references to the details of schooling the various breeds will be found in the succeeding chapters; but the reader may once more be reminded that no hard-and-fast rules can be laid down for training, as the constitutions and tempers of horses so widely differ from each other. The chapter on Training the Trotter contains many suggestions on special treatment which may be read with benefit by those who contemplate the preparation of other breeds of horses.

TRAINING THE THOROUGH-BRED

As may naturally be supposed, a great deal of difference exists between the methods of trainers of thorough-breds, not merely as regards their treatment of individual animals, but in connection with the entire principles which regulate the preparation of race-horses. Some persons are still advocates of "strong" preparations, entailing a tremendous amount of work upon their charges, whilst others are believers in sweating the horses for miles under heavy rugs; some also go to the length of Squire Osbaldiston, who used to state that "one month is necessary to prepare a horse for a race, but if he be very foul, or taken from grass, he might require two". There are those again who take an entirely different view, and are in favour of a slow and gradual preparation.

It is, however, probable, that the views of the extremist on either side require considerable modification save in very exceptional cases, and at all events there is no reason to question the soundness of the old adage that a hurried preparation is never satisfactory to man or beast. In regard to the amount of work which should be given a horse it must be left to the discretion of the trainer to decide. Some families, and notably the New-

minsters, usually do best, or at all events in some cases remarkably well, upon a course of very easy work, whilst other animals are perfect gluttons, and require a large amount of exercise to keep their flesh down and their condition up. Constitution, temper, habit, and idiosyncrasy are seldom alike in different horses, and even the same horse may change in these respects from time to time. Nothing, therefore, in the shape of a hard-and-fast rule can be laid down for the instruction of a trainer, who can only be guided in his treatment of each animal by the knowledge gained of him while under observation, and the amount of progress the horse makes.

Yearlings, after being mouthed and broken to driving-reins after the manner described in the chapter on Training the Trotter, may be mounted and gently taken by degrees through all their paces until they become perfectly handy, when they may be regularly exercised, but always by themselves. In the matter of work, three, or at the most four, furlongs should be the limit of a yearling's canter, as if this distance is exceeded the strength of the juveniles is certain to be overtaxed, to the prejudice of their future speed and stamina. In the case of older horses being trained for long distances, it is not desirable that they should commence by galloping a course of the length they will have to run, but may begin at a mile and gradually work up to the full distance. It is also a very bad and objectionable practice to gallop any horse the long course at full speed; but, on the other hand, steady work over it will be necessary to strengthen his wind. The requisite number of strong gallops will depend in part upon the condition of the animal, and in part also upon the weather and state of the ground; as when the going is heavy the efforts of the horse are correspondingly increased.

Some trainers through conviction, and others through necessity, give their horses comparatively little galloping to do; indeed, Tom Oliver was wont to boast that he could get a steeplechaser fit for a two-mile race by merely walking and trotting him about; but this is a bad principle to work upon in ninety-nine cases out of every hundred. Long four-mile sweats under heavy rugs were condemned by the best of the old writers upon preparing horses, in spite of the fact that Samuel Chifney, in his book, speaks of sweating horses six miles three days a week. A severe course of sweating is objected to by most trainers of the present day, for even though the practice is popular with some people, there can be no doubt that if carried to anything like excess it is weakening to the horse. If horses in training are away from their stables for an hour and a half at a time it will be quite enough for them, and it is always best to avoid taking them out during the heat of the day—early in the

morning during summer, and as soon after breakfast as possible in the winter, being the best time for the heavy work.

The earlier horses can be got to work in the spring the better it will be for all parties concerned, as their preparation then need not be hurried, though, of course, animals with early engagements before them must be rattled along whenever the state of the ground permits. Those, however, which will not be wanted until later can be given just enough exercise to prevent them from getting big, but not sufficient to cause staleness when their preparations begin in earnest. On the other hand, even if the presence of a long frost has necessitated slow work on the straw bed, it is not desirable, except in very exceptional cases, to gallop a horse severely directly he gets back to the training-ground, lest undue pressure should break him down. Although, of course, the two-year-olds will not be wanted until the season is well on, they should nevertheless be kept gently at it under the tutorship of a steady school-master, whom they should be permitted to beat when anything like fast work is indulged in, else they may be encouraged to turn out faint-hearted on the Turf.

The responsibility of discovering whether a horse is possessed of stamina, or deciding whether he be merely a sprinter, devolves upon the trainer, who must also settle the question of fitness. This is proved by the state in which an animal pulls up after a good gallop. If there is a heaving flank and dilated nostrils, the horse requires another gallop, and so he will if he finishes tired. On the other hand, sweating is not by any means an infallible sign of unfitness, as many horses will sweat even though they are drawn to the limits of fineness, which is perhaps the condition in which most thoroughbreds run best. Were it possible to get horses to do their abilities full justice when run big, it would be a relief to the trainer, and in fact the best for all parties concerned; but, unfortunately, the vast majority of animals require to be run light, and therefore their preparation becomes a more serious matter than it would otherwise be.

Trials.—No race-horse, or at most extremely few, is sent upon the course without having been previously subjected to the ordeal of a trial at home, but it is very questionable whether these tests are of anything like the value which they are supposed to be. In fact, it is something like asking too much of a horse to expect him to run up to the same form upon two or three different occasions, as there is no knowing how the animal may be feeling at the time he is being put through the mill. Chifney, in his "Genius Genuine", asserts that an animal named Magpie would run the same distance nearly two hundred yards better on some days than on others, and few people who have written upon the subject of the race-horse

have been in a better position to express an opinion upon such a subject than he. At the same time there can be no gainsaying the fact that, assuming the trial horse is in form and willing, trials must be regarded as being very valuable guides to trainers in estimating the merits of their charges, though, it may be repeated, there is a tendency on the part of many supporters of the Turf to attach a great deal too much importance to the results of home efforts.

SCHOOLING THE HUNTER

The earlier days of the hunter that is to be are beyond all question far happier than those of any other breed of horse, and, in fact, until old

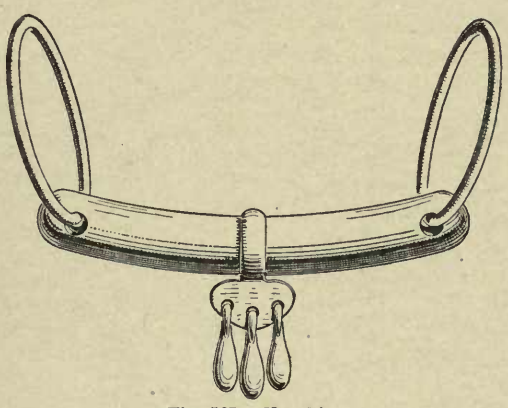


Fig. 567.—Key Bit

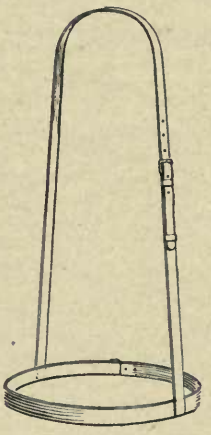


Fig. 568.—Cavesson

age or accident has rendered him unfit for work, a horse of this variety may be regarded as the most fortunate of all the members of the equine world. For, at all events, the whole of the first twelve months of his existence the hunter is permitted to enjoy a life of absolute immunity from all annoyance, the best of everything being provided for him in the way of good pasture and keep; and, though he may have been handled by his attendant, it is not the custom to attempt to lead him until he is well into his second year. Having then accustomed him to the feel of a bit (fig. 567) in his mouth, and to wearing a cavesson (fig. 568) or a head-stall and a surcingle as described in the chapter on Training the Trotter, the youngster should be well initiated into the mysteries of long driving-reins before being subjected to the lunging operations which are regarded as indispensable to the education of the future hunter. It is desirable, however, that the colt or filly should be pretty steady in the driving-reins before lunging commences, as the latter takes a good deal more than many

persons may imagine out of a young horse; for at first he is worried and perplexed by learning what to do, and when the lesson is properly learnt it is hard work to be sent round in a circle for so long a time as many two-year-olds are. To vary the monotony, the breaker should repeatedly reverse the direction of going round, sending his pupil first to the right and then to the left, taking care that he always leads with the right leg, and checking him as soon as ever he breaks from the canter into a gallop. The lunging should not be a long affair, half an hour, including the

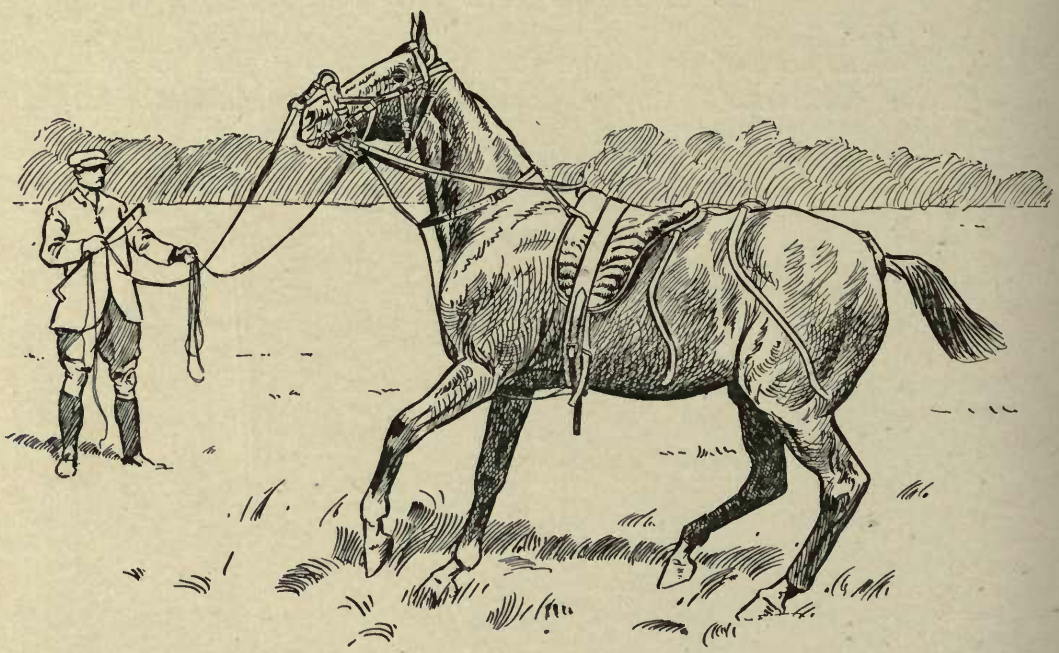


Fig. 569.—Lunging Tackle

necessary halts for rest and the rectification of faults, being amply sufficient for each lesson; and when the youngster has become quite steady he may be tried over small obstacles to teach him how to jump, but always kept on the lunging rein. Most colts require a little humouring at first when it comes to leaping, but patience and kindness soon teach them what they are required to do, and every possible effort should be made to spare them injury and save them from being frightened when an obstacle is first presented to them to negotiate. Falls and bumps will come quite soon enough to warn the colt of the unpleasant consequences which succeed a mistake; and, above all things, it is necessary to give him confidence at the start.

First Mount.—At three years old the embryo hunter is usually backed for the first time, but before any attempt is made to ride him he should be

thoroughly accustomed to the sit of the saddle and the grip of the girths. This done, mounting and dismounting should be quietly repeated again and again until he is thoroughly familiar with what is required of him. The precaution of engaging the services of a light-weight rider if the breaker is a heavy man is most desirable, though it is preferable, if possible, for the colt to be first backed by someone with whom he is familiar. No attempt should be made at this time to bully him into submission if he is disposed to be fractious; a snaffle-bit and light hands, supplemented by verbal remonstrances and a good seat, are all that the breaker requires, provided he is endowed with the golden gift of patience, as all breakers should be. If the colt manages to get him off, the rider will have reason to regret the mishap, for the pupil will have acquired a knowledge of his superior power, and will probably be desirous of repeating the operation; but he must speedily be remounted, and kept well at it, walking about, or trotting if his education has proceeded so far, in order to disabuse his mind of the idea that if he tries he can be master.

Jumping.—When the time arrives for the first jumping lesson he should be accompanied by a steady old horse which can be relied upon not to refuse, but after the pupil has gained confidence, and displays a willingness to take his leaps alone, the services of the school-master may be dispensed with, and the colt may be schooled by himself. At four years old or earlier his education should be sufficiently advanced for him to be taken out cubbing, where he will get a look at hounds and their belongings; but the greatest care should be taken when he first appears in public to prevent him from being upset by the novelty of the surroundings, as if permitted to have his own way at this time the horse may be ruined for life. Consequently, it is not desirable to bring a promising colt of which great things are expected, and which may probably grow into money, out too soon. A little patience will be amply repaid later by escape from accident and a larger price being obtained for him; and he will find plenty to learn if properly schooled at home, without being subjected to the excitement he will meet with at the covert side, or the strain which will be put upon his immature energies when the hounds are running.

His schooling being completed, the five-year-old hunter is fit to take his place in the field, but a hard-riding owner should remember that after all he has only a baby under him, and should therefore be careful to spare his mount as much as he can. Anything like stopping on the way home should never be thought of, but if the journey be a long one, or the horse pumped, a drink of gruel is a merciful provision which should be procured at the earliest opportunity. On arrival at the stables the

worst of the mud should, if very thick, be scraped or brushed off, no water being applied to any part of the body but the muzzle and dock, as the application of water increases the chances of mud-fever supervening. Have the horse rubbed dry, his ears pulled, and legs bandaged and well cooled; clothe him and leave him for an hour or two to enjoy his food and well-earned rest. After which a brisk rub over with a wisp will suffice until morning.

Treatment in Summer.—It is still common practice to turn hunters out to grass for the summer, but many sensible men are averse from exposing their animals to the heat of the sun and the torments of attack from flies, and therefore bring them into boxes for the day-time, providing them with a feed of corn and some hay, and turning them out into a meadow at night to enjoy the cool air, and receive the benefit of the dew on their feet of a morning. Other owners simply reverse the shoes and treat their horses as described in the chapter on Training the Trotter; whilst some keep them more or less in work all the summer with a view to retaining the desired hardness of condition, and thereby dispensing with the severe course of training which has to be resorted to in the month of August, in order that the animals may be quite fit to go in September. Of all these courses that which ensures the hunter being out at grass of a night and in a cool, shady box during the day is the one which commends itself most strongly as the best to pursue, but each case must be governed by its own peculiar circumstances; and it is not every hunting man who is so fortunately circumstanced as to be in a position to treat his horses exactly as he would desire.

PREPARING THE SHOW HORSE AND HARNESS HORSE

All the varieties of show horse, be they hunter, hack, or harness animals, require a similarity of treatment in order to prepare them for competition in the show-ring. It is, of course, evident that each variety must require a little different schooling, but all are fed and managed on the same lines, the object of the owners of each being to send their animals in before the judges in as blooming condition as possible, not so fat as to lather and blow, but quite fat enough to conceal their faults, and as fit and fresh as is possible for them to be. High feeding is consequently a most important feature of the preparation of a show horse, save of course in the case of the deep-ribbed, gross animals, which, if over-fed, let down too much about the belly, and these must be treated to plenty of judicious work, and be only fed upon sound, hard grain, with a little chaff and hay.

Should the animal be brought up from grass, it is a good plan to give him a dose of aloes (about 5 drachms for a big horse, and less in proportion for smaller ones), preceded by two or three bran mashes, and after that the less physic he gets the better. In the case of a short-ribbed horse, a good deal of time must be spent in endeavouring to get his belly to drop, and thereby take away the tucked-up appearance which disfigures so many movers. If this end is finally accomplished it will generally be through the assistance of a system of feeding which, though it does not commend itself to a man who requires his horses for work, is absolutely essential to the purpose of a stud-groom who is in charge of a naturally short-ribbed, narrow-middled animal. Great care should be exercised in the cleansing and washing out of his manger after every feed, and the removal of every particle he has not consumed. It is best to mix all his grain with chopped stuff well damped or even scalded, as the moisture assists in dropping the body and thereby concealing the shortness of rib. The eternal question of exercise depends, as it does in the race-horse and trotter (which see), upon the discretion of the trainer, as not only do constitutions vary in horses, but in the case of high-movers the feet will be much less tried by the lofty action of some than will be the case in others. There is not, however, any great necessity to give the majority of show horses very severe work, though in the case of the hunter, which should appear muscular, it is desirable that he should be ridden regularly and supplied with plenty of hard food. As the amount of exercise is therefore somewhat limited, and the feeding light, a periodical dose, perhaps once a month or so, of an alterative medicine should be administered, and this, with the addition of some carrots to the diet, will usually succeed in keeping the blood in order.

The Show Hunter.—The preparation of the show hunter after the animal has been "broke" is very similar during its early stages to that adopted towards other varieties of horse; but when he comes to be ridden and got ready for the show-ring, both skill and patience have to be expended in the bridling and bending of him. The steeple-chaser, or business-hunter, can be allowed to slip along with his nose forward, but the show horse requires bending and pulling back on his hind-legs to make him go off the ground and flex his hocks so that he may look smart when ridden. The question of finding a suitable bit for the animal is therefore a matter of serious consideration, whilst the hands of his rider also have to be studied. Severe bits are always to be avoided when young horses are under treatment, and, in fact, the less that old ones have to do with them the better, and therefore, when side reins have to be shortened on a colt, the more tender the bit, the better the mouth

is likely to be in after-life. In making the show hunter it is necessary to commence with slow work, and work along gradually, teaching him to carry himself as he should do, first at the walk, then the trot, and so on to the canter and gallop, the instructor always bearing in mind the great importance attached to carriage of the head and the tucking of the hocks well under the belly, two points which can usually be greatly improved by judicious handling.

In the **hack** and **harness horse,** action is, of course, the greatest of all points to be obtained, and many and peculiar are the devices resorted to to accomplish this. Stories, in fact, are told of tin pots having been attached to the tails of dogs, in order that the antics of the latter and the noise between them might cause the horse to pull himself together. Such tales, however, carry with them the stamp of improbability; but there can be no doubt at all that many persons teach their horses to step high by exercising them over timber or railway-sleepers, arranged far enough apart to permit of the animals finding room between them, and lofty enough to ensure their bending the knee. Others trot them over a long run with furze or straw knee deep, and ride or drive them regularly in practice thus; whilst others rely implicitly upon the efficacy of weights upon the feet. These weights consist of india-rubber tubing filled with shot, and fastened round the fetlocks. No doubt, after wearing the latter the horse feels relieved when they are removed, and is likely to lift his knees higher than before.

Many very experienced showmen, amongst whom is Mr. Alfred Butcher of Bristol, who during the past ten years has probably taken more prizes for harness horses than any six other persons, do not attach any value to such methods as the above for improving the action of show horses. At all events, such an animal, to be successful, must possess natural action to commence with, and must, moreover, have pace as well. If not, no amount of artificial aids to movement will make him a first-rater; whilst, if he possesses these merits, it is contended that he can be improved by more legitimate methods. According to Mr. Butcher, the first great secret to be discovered is the horse's best pace, as every animal has some particular one at which he shows off his action to the best. Then each horse must be shod according to his style of going, it very rarely happening that two animals in the same stable, unless it is a very large one, will be suited with the same weight and shape of shoe. A third and equally important question to be solved is the style of bit which suits each particular horse; whilst, finally, the hands of the coachman have to be considered, as it frequently occurs that horses will move splendidly when driven by one person, and go all to pieces when handled by another,

although the two men may be equally good whips. It is a certain fact, moreover, that most good harness horses, and many saddle ones as well, are by no means pleasant animals to handle, and have to be humoured and studied in every possible way when at work, and consequently it is no use trying to win prizes in good company with a horse which is not upon good terms with his driver.

Pace, no doubt, can be improved, and action also to a certain extent, and therefore a reference may be made to the chapter on Training the Trotter, in which information will be found regarding the methods principally resorted to in America for increasing the speed of this class of animal, and preparing him for his engagements. Assuming that an animal is temperate, it is desirable that he should be brought into the show-ring before the judge as fresh as possible; but if, on the other hand, he happens to be of an excitable disposition, a good gallop if he be a hack, or fast trot if he be a harness horse, an hour or so before the judging, will benefit him if it can be arranged for. Time, however, should be left for the animal to cool down in. Above all things, be the system under which you prepare your show horses what it may, always try to avoid conveying an impression of artificiality to the judges. Don't let your horses come into the ring with their mouths full of iron, and wearing martingales and bridoon bits, if you can help it. Many a judge, and very properly so, would hesitate to award a prize to animals treated thus; as he would naturally, if he were a practical man, arrive at the conclusion that they were either useless without them so far as the carriage of their heads is concerned, or else unmanageable beasts which could not be trusted safely without such restrictions being placed upon their liberty. That a superabundance of harness is not in the least degree necessary to ensure success in the show-ring is proved by the fact that it is rarely, if ever, that Mr. Butcher drives a horse which carries even a bearing rein, and yet his successes have been so many as to be almost past calculation.

TRAINING THE TROTTER

The sport of trotting is not one which has ever taken very deep root in this country, nor is it in the remotest degree probable that it will ever rival horse-racing, as the term is accepted by Englishmen, in the estimation of the public. On the other hand, trotting is the great popular sport of America, and therefore it is by no means to be regarded as surprising that a few admirers of this gait are endeavouring to increase the interest taken in it by their fellow-countrymen on this side of the Atlantic.

It must, moreover, be borne in mind that many Englishmen, though uninfluenced by any desire to race their horses, endeavour to increase the speed of their animals, and consequently a few lines devoted to the main principles of the successful preparation of a trotting horse may assist in attaining the object of these owners.

The Yearling.—In America yearlings are raced (of course trotting is referred to), and as the foals are usually dropped about May, it is necessary to commence their education at a very early age. They are, therefore, usually weaned by the New Year, having been haltered when only about a fortnight old, and frequently handled whilst at the foot of their dams. As soon as their education commences they should be gently and tenderly led by the halter on a straight, level, and well-secluded road or track, a bit having been previously placed in their mouths; but this should not be attached to the head-stall, or used in any way, being merely put there to familiarize them with the feel of it. After the colt leads quietly, a surcingle with side-straps may be added, but the side reins should be at first quite long, so that he cannot injure his mouth. After a day or two they should be gradually taken up, whilst, as before, he should be led by the halter and not by the bit. When he goes steady, have him shod with tips, and accustom him to the use of the crupper.

After about two months of this sort of work the regular breaking harness may be put on the yearling, care being taken to fasten up the traces and tugs in such a manner that they cannot flap about or trail on the ground, and so frighten the youngster. Do not put him into a vehicle of any kind until he has become quite accustomed to the harness, but exercise him steadily in long reins, and encourage him to reach out when set going. After he is quite handy in leather, introduce him to the breaking-cart, letting him examine it well before placing him between the shafts, and taking care not to disgust him with the conveyance by jerking at his mouth or treating him roughly if he gives trouble at first. When the colt is steady in the breaking-cart he may be put in the sulky, being by this time probably about a twelvemonth old. Have him shod lightly, but on no account hurry him—in fact, commence to drive him on the track rather slowly at first, permitting him to indulge in a fast spurt only now and then. Never let the youngster go more than a quarter of a mile at his top speed during the earlier period of his education in a sulky; and if he can do this distance a few seconds inside the minute it will be a satisfactory, though not a remarkable, performance.

About the end of June he must be sent along faster in company with an old horse to lead him, and should be taught the art of starting and getting away smartly. Teach him also to quicken up when called upon,

MR. WALTER WINANS' TROTTER, JOE W.

MR. WALTER WINANS' TROTTERS, LYRIC AND SAMOS

and encourage him to obey such admonitions to go faster at every part of the track, upon which he should always be driven now, so that he may become accustomed to the turns. The distance travelled each day must entirely depend upon the colt, as some animals require an amount of work to keep them fit which would knock up others. Finally, the yearlings should be tried about the last week in July or the beginning of August.

The training of the made trotter resembles the final stage of the yearling's preparation, so far as the daily exercise goes, as this must necessarily vary in the case of different horses. Trainers, moreover, are not all of one mind upon the subject of walking and jogging exercise. Mr. John Splan is of the opinion that a horse can have too much of it; and consequently he favours plenty of slow heats, adding to this piece of advice the information that "if he"—the horse—"is any good when he gets into condition, he will show you the speed". It, moreover, stands to reason that the speed of any horse will be prejudicially affected if he is being continually sent along at full speed. He should, therefore, not be driven as fast as he will go; and occasionally, if not always, he should be exercised in good company, the trainer taking care to use his best endeavours to make the horse obedient to his voice. Should he break, take hold of his mouth gently and talk to him, the use of the whip under such circumstances being greatly to be deprecated. It is desirable, too, to have two sets of sulkies, a heavy one for road work, and one of a lighter build for use upon the track; and the greatest attention should be paid to the question of shoes, as no two animals require these of identical weight and make. Boots should also be worn, and especially skin boots on the hind-legs, the limbs being carefully examined every time the horse comes in; and if there are any signs of a bruise, or if there appears to be any prospect of the horse hitting himself at any point, that particular part should be carefully protected and the shoes examined, and, if necessary, removed, altered, and readjusted.

Always endeavour to avoid over-exercising a trotter, and never permit him to extend himself on muddy or very hard ground. The latter, sooner or later, is certain to produce concussion or bruises, and to obviate it many trainers shoe their horses with a strip of sponge an inch thick inserted between the iron and the hoof at the quarters of the foot. A poultice of boiled turnips is also recommended for bruises, in order to reduce the inflammation; but whatever course of treatment is pursued, the earliest possible attention should be paid to any injuries to the feet and limbs, not only of the trotter, but of all horses which are being schooled.

The autumn and winter treatment of adult horses which have had a hard season's work will depend a good deal upon the condition in which

the animal concludes his trotting for the year. Should he finish up fresh and well, he may be kept in easy work, and only require attention lest he lay on superfluous flesh, which will take trouble to get off when he comes to work again in the spring. On the other hand, if the legs are stale, as they probably will be, the horse may be put up in a loose-box with a yard attached to it, his clothing being gradually removed until all has been taken off, his winter coat being quite sufficient protection. He should be shod with tips only, so that his heels will let down and expand, and if left ungroomed he will take no harm. It is not desirable to turn him out, as the exposure may injure his constitution, and the absence of regular feeding will do him no good; added to which, he may injure his feet on the hard ground when frosts come. Should blistering be necessary, keep him in the stable on cooling food, in the company of other horses, during the ordeal; and, when convalescent, place him in a loose-box, as recommended above, keeping him on a moderately low diet, unless he has early spring engagements ahead. Many trainers permit the horse to have a few hours in a meadow on fine days, and this is no doubt beneficial in many cases.

Beginning a New Season.—When the time comes for training again, it is advisable to proceed slowly. A mild dose or two of physic should precede the course, but no attempt should be made to get flesh off in a hurry, and therefore sweating and strong medicine should be avoided. Neither should the internal organs and legs be overtaxed by overfeeding and hard work at the commencement. Some people consider it desirable that the winter coat should be clipped now, whilst others are of the opinion that it should be allowed to come off naturally, the process not being hastened by any artificial means. Perhaps a medium course is the best of all, however, and the coat may be allowed to remain on until strong work commences. After about ten days' slow work the horse may be permitted to slip along, and when he comes in sweating he should first of all be well scraped. Then he must be blanketed and walked about gently to cool, after which he may be taken into the stable, given a little gruel or chilled water, washed, dried, and bandaged.

A week after his first sweat he may be tried to see if he retains his speed; but it is a bad thing to overtax him the first time, and too frequently repeated trials are sure to ruin. The animal must, therefore, be watched, and his trials and work regulated by the progress he makes.

Food.—References have already been made to feeding in the chapter on General Training, but about 10 lbs. of oats a day will be found the daily average consumed by the trotter. Some horses, however, require far more than this amount, and such was the great Rarus, which, Mr. Splan writes, required a full 15-lb. allowance when in hard work.

STABLES

SECTION VIII.—STABLES

THE BUILDINGS AND FITTINGS

In no country so much as in Britain is the horse at once the friend and the companion of man, and in no country is he so well housed. The arrangement and the construction of a gentleman's stable are of an importance second only to that of the dwelling-house itself; indeed, it is to be feared that in some cases the accommodation provided for his equine servants claims more thought and care than that provided for his human ones.

In selecting a position for the stables, something, of course, will have to be left to the special exigencies of the site, but a few general principles may be laid down. While naturally taking somewhat of a rearward position, they should be easy of access from the front entrance and approach. It is not perhaps desirable to have them in too close juxtaposition to the domestic servants' yard and offices; but they should be of easy access from the master's office or study, and from the side entrance used by the master of the house and his family. As it is not desirable to have too many back lanes or approaches likely to be neglected or to form a loitering-place for idlers, it may be well to arrange the stable entrance so as to be at the same time accessible from the main carriage-drive, and yet available for such purposes as the removal of manure, &c., without such operations being unduly in evidence.

Decoration.—Considering the importance of the stable department, it would seem proper to give it a fair amount of architectural embellishment, always bearing in mind, however, the sound maxim that utility is the cardinal principle in all building, and that the truest architecture is the artistic treatment of the useful. Whatever style is adopted in the dwelling-house should be applied in a plainer degree to the stables. The material, so far as it affects the internal fitting up, will be more suitably dealt with at a later stage; but as regards general construction, the local materials will usually be found most suitable. Brick, stone, or even wood

may be applied; but the last in this climate is seldom durable, except at a considerable expense in the way of periodical painting or coating with other preservatives.

In the general arrangement of a stable there are many points to be considered. The modern horse is, like the modern man—his master,—an artificial product, and, like him, is easily affected by healthy surroundings or the reverse. There are few of the principles of modern sanitation which are not applicable to the stabling department. A dry and well-drained site, air, light, and ventilation without draught are all indispensable for a healthy suite of stables. Cess-pools under or close to a stable, and any large or long-standing collection of manure in close proximity, should also be avoided.

The principal accommodation required in a complete stable range will consist of stalls, loose-boxes, one or more sick- or isolation-boxes, a washing-box or shed, coach-house, harness-room, cleaning- and saddle-rooms, a provender-room, tool-house (which may possibly also be made available for a heating apparatus for hot-water pipes to the coach-house), and lofts for hay and corn. The last-named may be partly over the stable, as tending to keep the latter at an even temperature; but the ceiling of the stable should as far as possible be air-tight, as the less communication there is between the air of the stable and the loft the better. For this reason it is desirable that the ladders or stairs to the loft, and the shoots for hay and corn, should not open directly into the stable, but, if possible, be in the provender-room or in a separate passage. It is also of advantage that a portion at least of the yard should be covered over for the more comfortable washing of carriages, &c., in wet weather. If this be done, a special washing-box for horses may perhaps be dispensed with, though it has its advantage on the score of privacy in the case of restive horses. It is better not to have the manure-pit inside the stable-yard, but at some distance, a portable iron box being provided for the removal to it daily, or more often, of all manure from the stable. Latrines for the stablemen should form a part of every well-ordered stable.

A typical plan is shown in fig. 570, with two stables of four stalls in each, a range of four loose-boxes, a sick-box, washing-box, harness-room, coach-house, fodder- or provender-room, and a tool-house. As the washing-box serves also for a passage, there is a direct communication throughout the range, except in the case of the sick-box, the isolation of which is rendered as complete as possible. Perhaps four ordinary loose-boxes, especially with the addition of a sick-box, may be in a larger proportion to eight stalls than is usually the case. Where hunters are kept, however, this number will not be too numerous, as the boxes will be used mainly for

the hunters, and the stalls for carriage-horses. If this is not the case, the end box can be cut off as a separate house for a root store or for dogs. Some persons also might prefer the loose-boxes to be entirely separate, with access only to the yard; but the horse is a sociable animal, and is more comfortable within sight and hearing of his companions. The advantages also in the matter of attendance, and the increased facilities for ventilation,

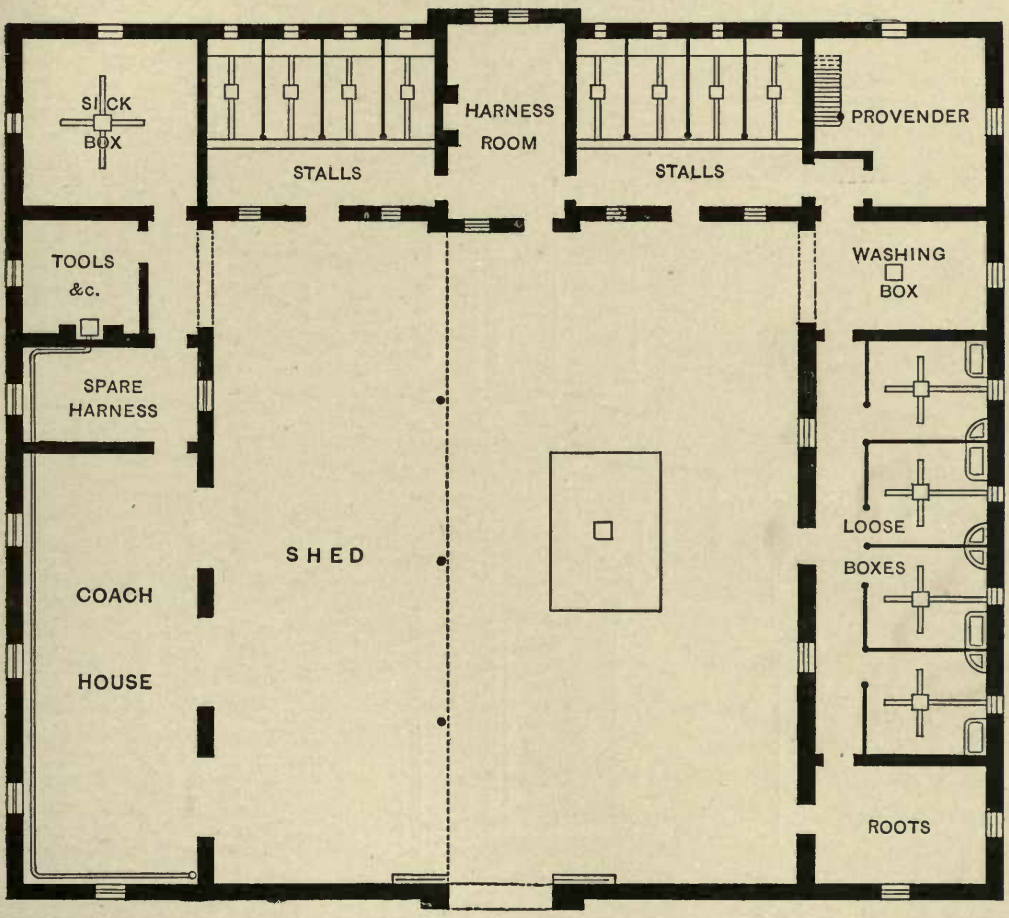


Fig. 570.—Plan of Stable-buildings for Twelve Horses

outweigh those of increased isolation. The covered part of the yard is shown with only three supports, the facilities for the manufacture of light-iron roofing rendering a multiplicity of columns quite unnecessary. It is not desirable that anything of the nature of a residence, especially where there are children about, should form any part of a stable range, although in some cases this is insisted upon; but apartments for at least one attendant should be provided, care being taken that, while accessible from the stables, they are not immediately over any part occupied by the horses.

The room over the harness-room is often found suitable for this purpose. It is not well to have too many stalls for horses in a single stable; ranges of four, or at the most five, with walls and doors between, are much better both for isolation and quietness.

Smaller Stables.—The quadrangular arrangement shown in fig. 570

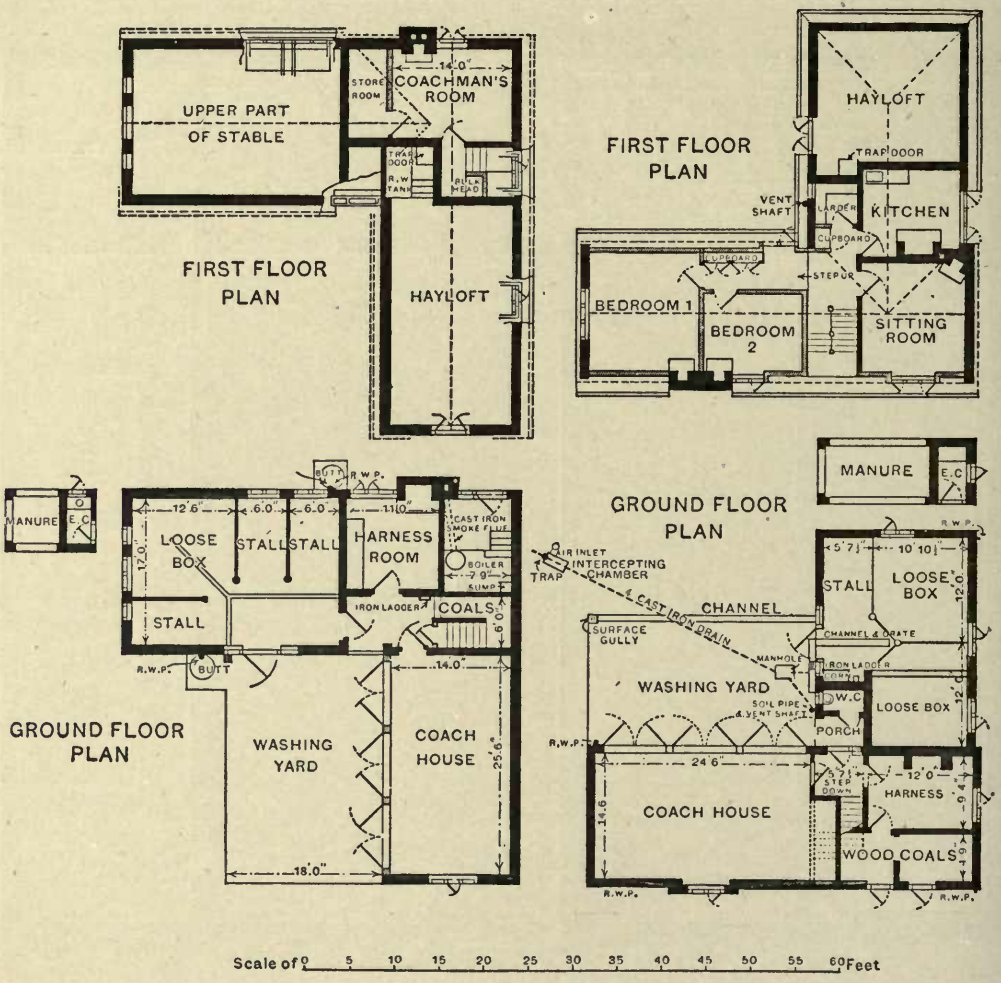


Fig. 571.—Plans of L-shaped Stables

cannot be adopted for small stables. As a rule the building takes the form of a simple oblong, the stable itself being at one end, the corn-store and harness-room in the middle, and the coach-house at the other end. The central portion may be carried up to a greater height than the others, in order to provide space for a hayloft or a man's room over the harness-room and corn-store. In many cases an **L**-shaped plan is the most suitable for the site, the coach-house serving to screen the stable from the garden or

from the house. Plans of two stables of this kind are shown in fig. 571. The accommodation provided in one plan includes a loose-box and two stalls for horses, and a smaller stall for a pony, a harness-room, heating-chamber, and coach-house; over the heating-chamber and harness-room there is a room for a man, and over the coach-house there is a large loft for hay, corn, &c. In the original design for this building, a corn-store was shown on the ground floor, two boxes were provided, and a glazed roof was shown over part of the yard in front of the coach-house. The manure pit and E.C. are at the back of the stables. The heating-chamber contains a boiler, which serves to warm, by means of hot-water pipes, not only the coach-house but also a range of lean-to green-houses built against the back wall of the coach-house. The other plan shows the plans of a building containing on the ground floor a small stable for three horses, harness- and store-rooms, and coach-house, and on the first floor a hayloft over the stable, and coachman's house over the other rooms. The stable and some of the other rooms were originally shown larger, but the sizes were reduced in order to bring the cost down to a specified amount, and consequently the plans cannot be regarded as entirely satisfactory. They serve, however, as an example of an economical range of buildings, and of one method of planning a coachman's house over part of the ground-floor space. Externally the two buildings, of which the plans are given in fig. 571, were designed to be in keeping with the adjacent houses.

Materials.—Some of the materials used in the construction of stables will be treated upon in the detailed description of the several parts. With regard to the walls and roof, there is no special material that is better than another; whatever most harmonizes with the dwelling-house, or is most characteristic of the locality, is suitable. Brick, stone, or even wood may be selected. Both stone and brick walls can be easily kept dry by building them with a hollow space in the centre. For the roof, slates are now generally the cheaper, tiles the more picturesque.

A good stable should be 18 feet wide inside, and each stall should be 6 feet wide. The divisions of the stalls should be at least 9 feet long, which will leave 9 feet for the passage behind the horses; or if the stall division is 10 feet, as is better, the passage will be 8 feet wide. A stable for cart-horses may be 16 feet, but the width of the stalls should not be less than 6 feet; narrower stalls are often made, but for large horses this width is indispensable. A good size for a loose-box is about 12 feet by 10, but boxes often vary much in size according to convenience in planning or caprice of the owner. The stable of olden time was a very dirty place, and among many stable attendants ideas and habits in consonance therewith too often still linger. In the modern stable, however, strict cleanliness is

almost as much a desideratum as in a hospital yard. Everything should be clean, bright, and pleasing to the senses. The gentleman's horse is often a nervous and fidgety creature, and every part of the fittings should be so constructed as to reduce to a minimum the possibility of his doing himself an injury. There should be no sharp or projecting angles in the stall-divisions, mangers, or other fittings with which the horse is likely to come into contact.

THE FITTINGS

The stall-divisions are usually fitted with cast-iron posts, which may be bolted to a stone block or provided with a hollow base which can be filled with and bedded in concrete, as shown in fig. 572. A ball or other rounded top is best for safety, and a very pleasing effect may be produced by having the ball of polished brass. The divisions should be of wood, grooved and tongued, and $1\frac{1}{2}$ inch to 2 inches thick, sliding into a grooved iron sill below and a curved or ramped iron capping above. A portion of the sill should be fitted, as shown in fig. 573, with a shifting-piece to allow the wood-work to slide in, for the convenience of replacing when damaged; when the shifting-piece is replaced, it holds all secure. The divisions may be of pitch pine or oak, but a very handsome and strong division is sometimes made of teak rubbed smooth and oiled. Many divisions have an intermediate rail, in which case the portion between this rail and the ramped upper rail may be of round iron bars, or iron trellis-work, which gives a much lighter appearance and facilitates the circulation of air. It is better, however, that the parts immediately beside the horses' heads should be filled solid, so that the horses, when feeding, cannot see, and possibly disturb, each other. Another advantage of the central rail is that it may be made hollow, to contain a sliding bar, which can be drawn out at night and the end secured to a staple or socket in the wall. This closes the passage behind, so that if a horse breaks loose during the night he will be safely confined to his own stall. A typical division is shown in fig. 573,

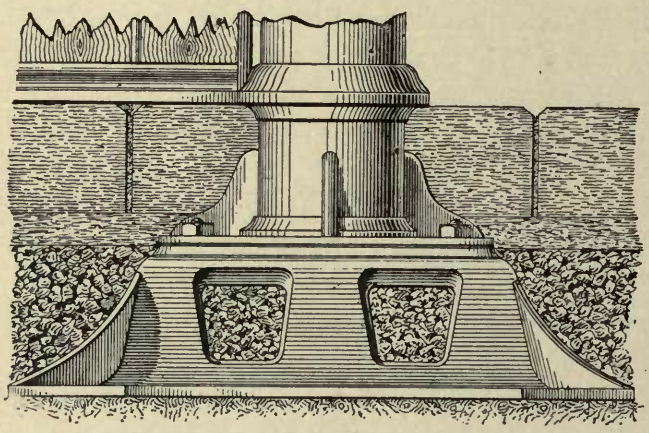
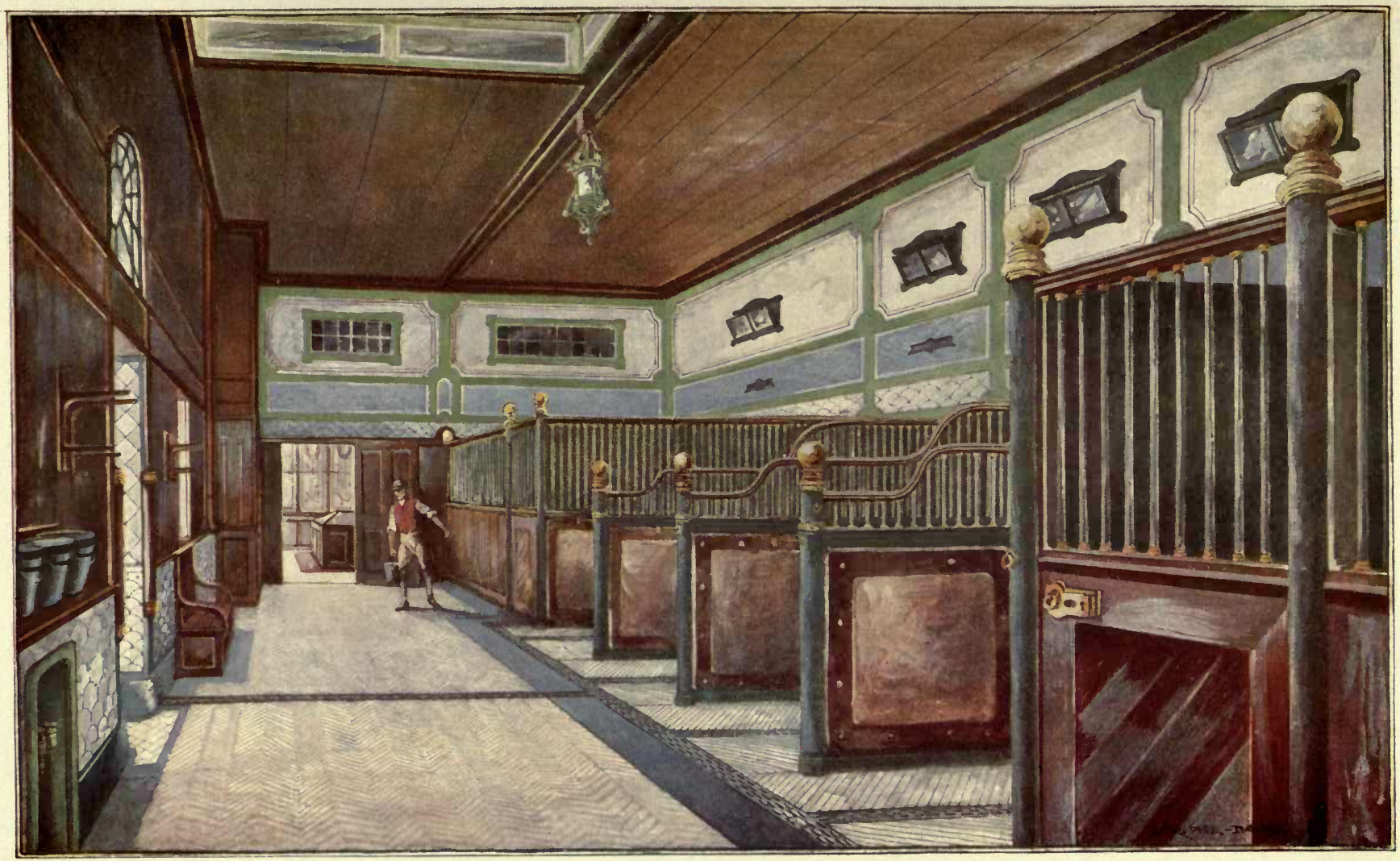


Fig. 572.—"Self-fixing" Base for Cast-iron Stall-pillar



A MODERN STABLE

Fittings by Messrs. Musgrave

which also shows in section a hopper window serving as a ventilator over the horse's head.

The divisions for loose-boxes are generally made of the same character as the stall-divisions, with boarding below and trellis-work above, which, in the same way as for the stalls, should be closed alongside the manger, &c. The latch of the door should be flush with the woodwork and of such form that the horse cannot "nose" it open. Loose-box doors may also be made to slide, but the special advantage is not apparent. A simple method of forming a loose-box is by continuing one or both end stalls of a stable back to the wall, filling the space by means of a door and short length of stall-division. This is economical, but has the disadvantage of leaving no thoroughfare in the case of a continuous range.

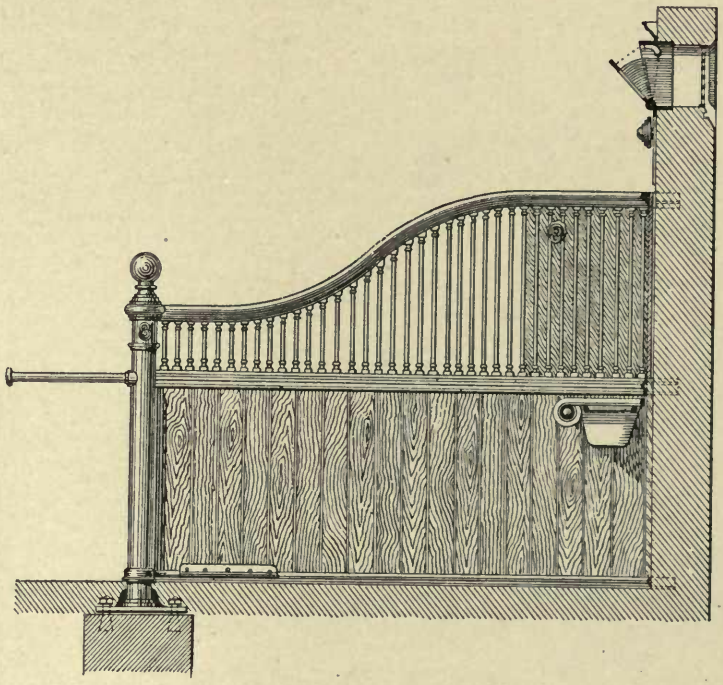


Fig. 573.—Stall-division with Shifting-piece in Sill for taking out and replacing the Woodwork

The lower parts of the **walls of a stable** are best lined with boarding, and the appearance is improved if this is secured into half-rails of iron at the top and bottom, to match the divisions. In a higher-class stable a portion at least of the space above the boarding should be lined with glazed tiles, and the tiles should be continued to the same level above the manger. The enamelled tiling is impervious to moisture, and, being on that part of the wall upon which the horse breathes, or with which his body comes in contact, is easily kept clean, and is not liable to decay. Salt-glazed bricks are now often used instead of wall-boarding, and are cleaner and more durable. The tiles above the wall-boarding should be of some light tint in preference to white. Dark tiles are not to be recommended. The upper part of the walls, if not tiled, may be plastered. Though more expensive, Keene's or some other hard-setting cement is

for hygienic reasons to be preferred, but ordinary plaster can now be cheaply coated with Duresco or other preparation which admits of being washed or renewed at a comparatively slight cost.

It is indispensable that the **stable-floor** should be impervious to moisture, capable of being easily cleaned, and with as few places for the lodgment of dirt as possible; the surface should have a sufficient foothold to prevent any risk of a horse slipping. The ground vitrified clinker stable-paving bricks meet these requirements, and should be laid upon Portland-cement concrete. In the ordinary paving bricks, the joints are at the bottom of the grooves, but it is better to have the grooves formed in the middle of the bricks, so that the joints are on the flats between the grooves. The floor should have as little slope as is consistent with the flow of liquids, so that the horses will not have to stand too much on an incline. Another excellent paving is formed with adamantine-clinker bricks. These are of a small size—6 inches long, $2\frac{1}{2}$ inches deep, and $1\frac{3}{4}$ inch thick—and are laid on edge in herring-bone fashion upon concrete, with rather open joints, and grouted with cement. These clinkers wear with a gritty surface, and, being so small, the numerous joints afford a good foothold for horses. They are made with chamfered edges as well as square. Similar bricks are also

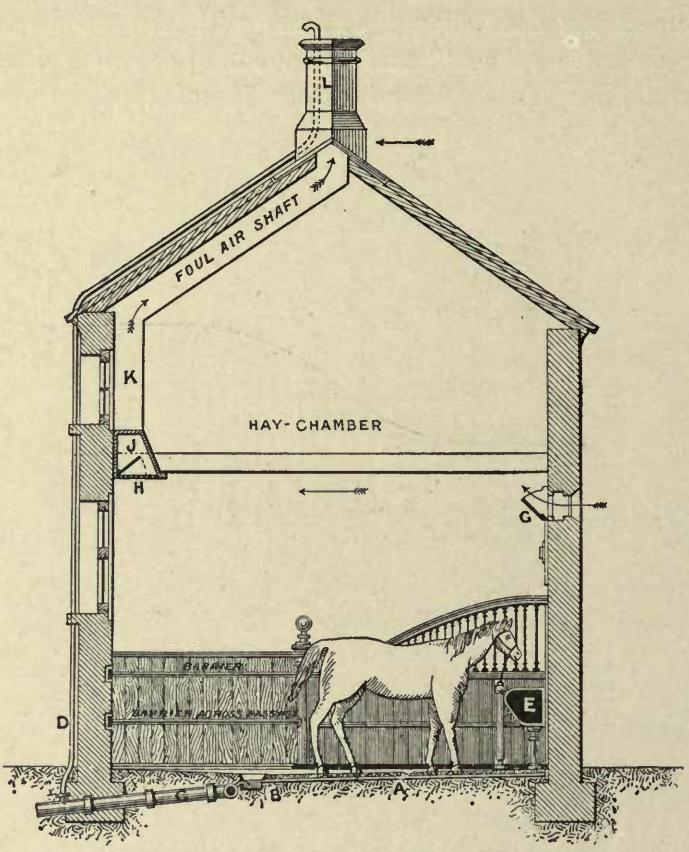


Fig. 574.—Section through Stable and Hayloft, showing Drainage and Ventilation

A, Surface-drain or gutter; B, Disconnecting trap; D, Ventilation-pipe from sewer; E, Patent waste-chamber of manger with movable waste-pipe into the gutter; F, Pipe through wall; G, Air-inlet; H, Air-outlet; J, Valve for regulating outlet of air; K, Foul-air shaft; L, Extract-cowl.

made a little wider. Granolithic paving composed of Portland cement and granite chippings, and laid on a foundation of brick or stone rubble, forms an excellent floor when properly laid by experienced men, and has the great advantage of being in one mass without joints. It can be grooved in any way, the surface figured as desired, and channels can be formed in it to any width and slope. Ordinary cement paving is, however, quite unsuitable for stables, as it is soon damaged by the horses' shoes.

The fitting up of **racks and mangers** has received great attention. The chief desiderata are: nothing that could injure a horse, or that a horse could injure, perfect cleanliness, and economy in the use of food by the horse. In many stables there are in every stall or loose-box three articles—a hay-rack, manger, and water-pot, but the last is often omitted. All these are best made of iron, with enamelled lining to the manger and water-pot. The hay-rack answers best when on a level with the manger, the old-fashioned overhead rack allowing dust and particles of hay to fall into the horse's eyes, besides often allowing the food to be wasted. The low or trough rack is not open to these objections, as hay dropped by the horse generally falls again into the rack. This may be fitted with a sliding grid, which lies loosely on the top of the hay. The horse eats through the bars of this grid, which follows the hay as it diminishes, and prevents the waste occasioned by the horse pulling out too large mouthfuls at a time. Another form often recommended has the bottom of the rack on a level with the manger, and in this case it should be fitted with a sloping perforated bottom, which allows the seed to drop through, and always keeps the hay close to the front of the rack and within reach of the horse.

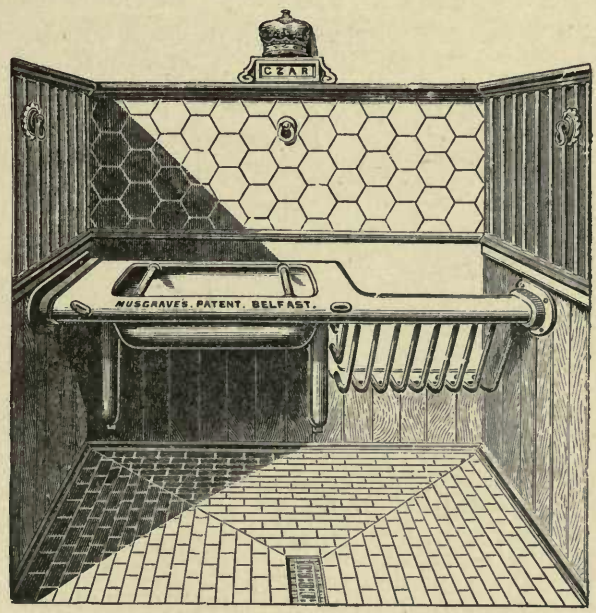


Fig. 575.—Manger, Hay-rack, &c.

The front of the manger should be of considerable strength, and rounded so that the horse cannot grasp it for "crib-biting". It is a great advan-

tage to have the water-pot made without a brass plug or chain, but on the "tip-up" principle. This can be so arranged that, while the attendant can turn it over to empty, the horse cannot possibly disturb it. The water is discharged into a waste chamber, from which a metal pipe leads to a continuation of the stall gutter; this is of great service for flushing the latter out. The tumbling principle may also be applied to the manger, rendering it more easily washed out when necessary. Another advantage in the manger is a cross-bar (fig. 575), which prevents the horse from "nosing" corn or other food over the edge.

The tying of the horse in his stall is of some importance, and in this several improvements have been made with the object of avoiding noise and preventing the horse (if startled or frightened) from injuring himself, or pulling away or breaking the manger. In the arrangement shown in fig. 576 the horse is not fastened to the manger, but the chain or halter works through a long slit in the top plate, or a front guide ring, which allows it to play as freely as if there were no manger before the horse. The bracket supporting the manger holds back the halter-weight close to the wall. The weight has an india-rubber buffer on the top, which, when suddenly pulled up, strikes a flat place below the bracket and prevents noise, besides checking to some extent the shock to the horse. The upper end of the manger chain or halter has a small ball, which stops when it comes to the slit in the top plate, and relieves the horse of the weight while feeding, the weight only coming into play when the horse draws back or throws up his head. There are several modifications of this principle, but all contain the buffer on the weight and the ball to prevent it from dragging needlessly upon the horse. Leather is sometimes substituted for the chain in the part passing through the ring, so as still further to reduce noise. The tying also is sometimes duplicated, so as to prevent all possibility of the horse breaking away.

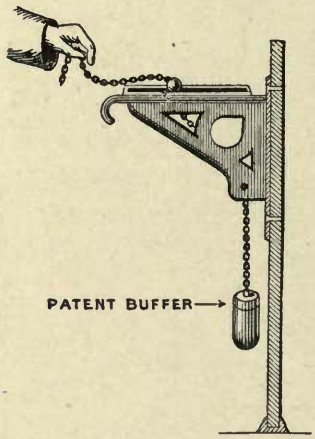


Fig. 576.—Musgrave's Horse-tying Arrangement

DRAINAGE

Channels should be laid down the centre of each stall and along the passage behind. The channel may be semicircular, of cast-iron, with a perforated flat top, in sections made to slide, so that by removing one of them the attendant can slide the other pieces along and clean out the

whole of the channel (fig. 471). By discharging the waste water from the drinking-pot into it the flushing of the channel is rendered easy. Some persons prefer an entirely open gutter (fig. 470), as being less liable to choke up from neglect. The chief objection to open gutters is that they allow the liquids to be absorbed by the bedding, retaining them within the stable and vitiating the air. Musgrave's pattern, as shown in fig. 577, has a fall in itself, and is often used; the channels or corrugations provide for the flow of liquids to the drain, while the surface is almost level, and offers a good foothold for the horse.

The underground drains should be made of glazed stoneware or cast-iron pipes, laid upon concrete and jointed in the best modern manner. It used to be the idea that, on account of the great percentage of solid matter contained in the drainage from a stable compared with the liquid portion, a very large diameter of pipe was necessary. The theory of large pipes for house-drainage is now quite exploded, and there is no reason why it should be retained in the case of a stable. The contrary rather should be the case, for a small pipe running nearly full will be better flushed, and there will be less deposit of sediment than with a larger one.

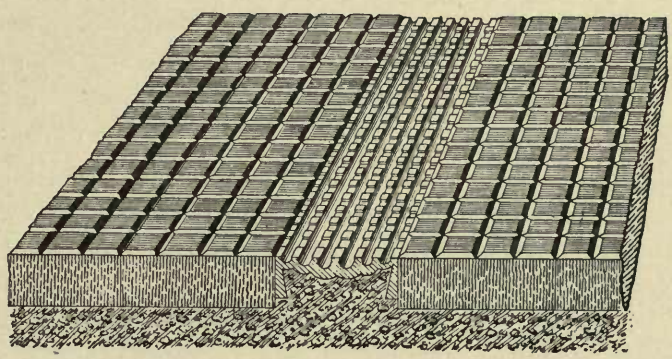


Fig. 577.—Musgrave's Patent Open Surface-gutter

The same arrangements must be adopted for stable drains as for house drains. All inlets to the drains ought to be outside the building, as shown in fig. 574, and ought to be trapped. The trap shown in fig. 475 can be used for this purpose. The surface drainage from the stable ought to be carried through the wall by an iron pipe discharging over the basket in the trap, and to prevent to some extent the risk of foul air being drawn through the pipe into the stable, a hinged brass flap (fig. 473) may with advantage be fitted on the outer end of the pipe. It is desirable to have an inspection-manhole with an air-tight cover at every change of direction or important junction, so as to obviate as far as possible any necessity for lifting the drains and breaking up the yards and pavement. Another manhole must be constructed at a short distance from the point at which the drain is connected to the public sewer or to the private cess-pool or

underground tank, and in this manhole an intercepting trap must be placed to prevent foul air from the sewer or cess-pool from entering the drains. To ventilate the drains an opening for air must be formed in this manhole, and at the head of the drains a drawn lead or cast-iron ventilating pipe not less than $3\frac{1}{2}$ inches in diameter must be carried up the building outside. These are shown in fig. 476.

The chief features of a **stable trap** are that it should be very strong, and afford a good foothold for horses, and that the attendant should be able to get his hand into every part. If by any accident it should be left open, the horse should not be likely to be injured if he put his foot into it; the trap should also provide as easy a flow for liquids as is compatible with a sufficient water-seal. Winser's stable trap, shown in figs. 474, 475, p. 85 of this volume, fulfils these conditions, and contains a perforated metal basket which prevents straw and dung from entering the drains.

Intercepting Tank.—Some corporations do not allow any connection between stable-drains and the public sewers, and an intercepting tank may sometimes be required. This tank should not be too large; it should be impervious both at the sides and bottom; the top should be closed with air-tight cast-iron cover, and due means should be taken for ventilation. Such a tank, however, must be viewed with more or less suspicion, and perhaps the safest way is to place it in a spot as little frequented as possible, with a ventilating grid made to lift easily, and to have it cleaned out at very short intervals.

VENTILATION

The ventilation of the stable is of supreme importance, as probably one-half of the diseases from which horses suffer may be traced directly or indirectly to defective ventilation. The method found most satisfactory is by the introduction of a small glazed ventilator (fig. 578) in the stable-wall, as high above the horse's head as possible. The fresh air, being thrown upward towards the ceiling, carries the air as heated and contaminated by the horse's breath towards the back of the stable. From this one or more shafts should be provided, according to the size of the stable, but at least one to every three or four horses, up through the loft, and

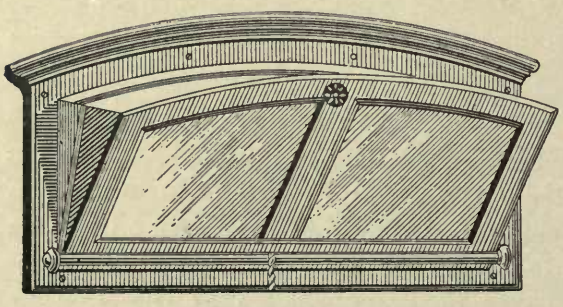


Fig. 578.—Combined Window and Air-inlet

discharging (if possible) at the ridge through a suitable ventilating-cowl. The whole system of ventilation is shown in fig. 574. Wherever practicable, windows ought to be provided in the front and back walls of a stable, and if another window can be placed in the gable ending, extending upwards to the ceiling, it will be a great improvement. These windows not only admit light, but, if made to open, can be adjusted to serve both as inlets and outlets for air.

In ventilation, as in everything else about a stable, simplicity is of the first importance. Beware of elaborate contrivances that look pretty upon paper, but require constant attention to ensure their proper working. An automatic system, depending solely upon the flow of the atmospheric currents, and the poise and the counterpoise always going on between the inner and outer temperature, and consequent weight of the air, may fail during some rare calm, or on an exceptionally hot day; but, on the other hand, it is independent of the stableman, who probably understands but little of the theory of ventilation, and is liable to be careless or indifferent even when he does.

Another method of ventilation, first suggested by Mr. Alfred Waterhouse, R.A., is a modification of that generally known as "Tobin's". The end of the stall-division nearest the horse's head is cast hollow, in the form of an oblong tube, at the lower end of which the air is introduced by a grating in the outside wall, and, passing up the hollow with an impetus towards the ceiling, spreads out all round without draught.

As before stated, the heated air from the stable should not be allowed to escape into the *hay-loft*, either through traps in the ceiling or through other openings; a special air-shaft should be provided, and the hay brought down through a shoot if possible in an outside passage, or in the fodder-room. The loft stairs also should not rise directly from the stable. To render the stable ceiling completely air-tight may not be easy, for plaster is not desirable under a hay-loft, and boarding, even when grooved and tongued, is apt to shrink and become far from impervious. Felt, or at least brown paper, laid under the floor-boarding, or over the ceiling-boarding, answers the purpose well, however, and is not expensive. The hay-lofts should, of course, be well ventilated by louvred windows, arranged to allow a full current of air through every part of the loft.

HARNESS-ROOM

A good harness-room is an indispensable adjunct to every stable, and, where a number of hunters are kept, a saddle-room also is necessary. These should be placed as centrally as possible to the whole group of

stalls and loose-boxes. One of these rooms is often a suitable place for the stairs giving access to a man's room above, and to the range of lofts. There should always be a fireplace, which is best fitted with a small range containing a large boiler to supply the hot water which is so often required in stable work. By continuing this boiler round both sides, as well as at the back of the fire, a very large supply will be always available.

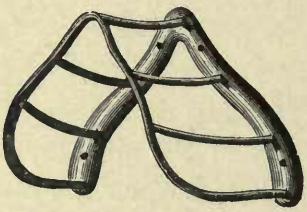


Fig. 579.—Pad Bracket for Single Harness

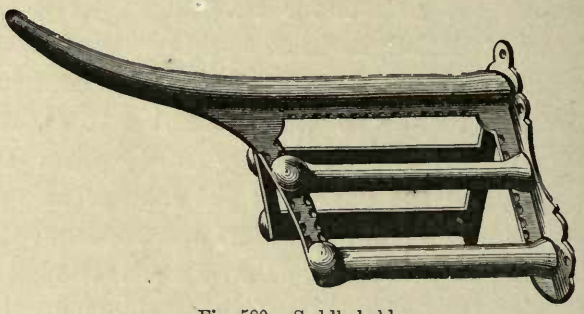


Fig. 580.—Saddle-holder

In small establishments the harness-room sometimes adjoins the coach-house, and a slow-combustion stove is placed in an open niche between the two. This may be sufficient to keep both places fairly warm and dry, but is of little use to give a supply of hot water, or for cooking. A harness-room may also, with convenience, contain a washing-sink, unless there is a separate cleaning-room, when it is better there. The tap over this sink will often be of service if the yard-cock is temporarily stopped

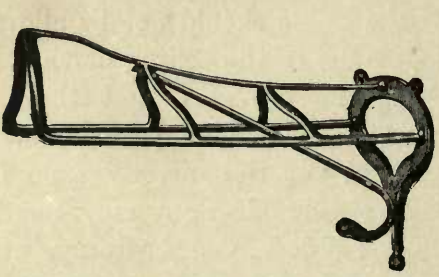


Fig. 581.—Saddle-bracket for Lady's Saddle

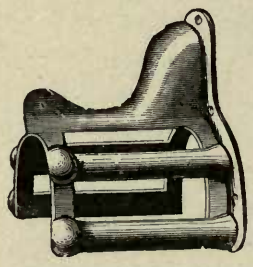


Fig. 582.—Collar-holder

Fig. 583.—Whip-rack

by frost or other causes. The walls of harness-rooms should, if possible, be boarded, both for dryness and for the facility of securing pegs, hooks, &c.

The furniture of a harness-room is now of infinite variety. Formerly it was entirely of wood, and tended often to be somewhat clumsy, but a combination of wood and iron has the advantage in strength, lightness, and appearance. Harness, being almost entirely of leather, and much exposed to damp both from the weather and the horse's body, requires, when hung up, to have the parts separated from

each other and open to a free circulation of air, in order to ensure rapid drying and to prevent mildew. It is impossible, within the limits of our space, to describe all the varieties of brackets for harness, saddles, collars, bridles, girths, whips, bits, reins, &c. Figs. 579, 580, 581, 582, and 583 will give some idea of the principles which guide the manufacture and use of such articles. A contrivance for airing the inside of a saddle before the harness-room fire is shown in fig. 584. This, when not in use, will fold up, and can be hung against the wall. A saddle-and-harness cleaning-horse, which combines a press and drawers for horse clothing and cleaning articles, with provision for opening out the saddle-horse to form a table, may be found very useful where space is confined. There are also many other conveniences, if not requisites, for the harness-room, such as brush- and sponge-drainers, chamois-leather and brush boxes, wall-brackets to hold carriage-lamps when not in use, &c.

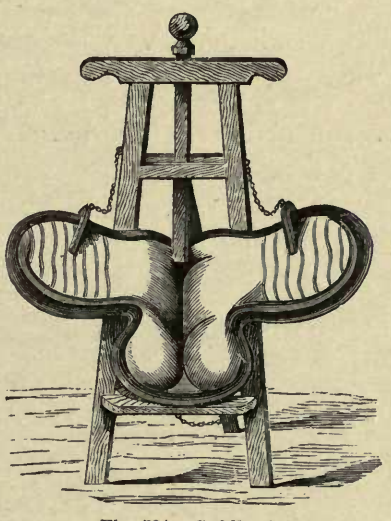


Fig. 584.—Saddle-airer

Spare-harness Room.—In large establishments it may be found convenient to have a spare-harness room for the reception of articles not in daily use, as in the case of town- or country-houses occupied by the family in turn for a part only of the year. This will apply especially to country-houses in which there may be a large influx of guests during the hunting season. Particular care should be taken of the warming of such a room, as leather and steel goods, when laid away, are very susceptible to damp. In regard to this, it may be borne in mind that stagnant air, even when warm, is more conducive to mildew than much colder air when freely circulated, and therefore that attention to ventilation is of great importance both in a harness-room and coach-house.

FODDER-ROOM

The fodder- or provender-room is indispensable where a large number of horses are kept. It should be fitted with bins overhead for corn, &c., and a chaff-cutter, and it is desirable that the corn-shoot and hay-shoot should discharge into this room instead of into the stable. These shoots are now made to measure the exact quantity of an ordinary feed for a horse. In large stables there may also well be an extra house for the storage of roots.

THE COACH-HOUSE

The coach-house need not be closely adjoining the harness-room, though in small establishments it may be convenient to place it so. In depth it should be about the same as the stable, *i.e.* 18 feet in the clear. The length will depend upon the number and class of vehicles to be accommodated. Although few carriages, even with lamps, exceed 7 feet in width, the doors should never be less that 8 feet wide, and are better made 9 feet or over. There is a great convenience in making the doors to slide, as when hung with hinges they are liable to be blown about by the wind. This can be accomplished by a little manipulation of the piers, and the sliding doors are generally hung with sheaves at the top to run along an iron bar. There should be small rollers at the bottom to reduce the friction. The floor may be laid with smooth flags, either natural or artificial, or concrete, but in this case especial care should be taken of the quality of the cement and sand used, as concrete may be very good or very bad according to the materials of which it is made. Asphalt is sometimes used, but is liable to become soft in extremely hot weather. Tiles are not desirable, for the risk of breakage. A coach-house should always have the means of being warmed. As before stated, in small places it sometimes adjoins the harness-room, and a slow-combustion stove is placed in a recess in the division-wall between, but in larger places a separate means of heating by hot-water pipes will be necessary, and, as in the case of the harness-room, some provision should be made for ventilation.

TOOL-HOUSE

The apartment for the hot-water boiler may be utilized as a coal-house, and for the barrows, forks, shovels, buckets, and other tools which form the necessary outfit of a stable-yard. Slow-combustion stoves are now made with a boiler sufficient to supply hot-water pipes for the coach-house and harness-room. It may sometimes be possible to combine an auxiliary pipe for the coach-house with a set for the green-house, but it is not desirable to sacrifice convenience in other respects for this purpose.

THE YARD

The gates for the yard are also, like the coach-house doors, more conveniently arranged to slide. They should be at the least 10 feet in width, and may even be more where dignity of appearance is sought. A side door should also be provided.

The manure should, if possible, be stored at a distance from the stable-yard, and removed by a small covered cart, or barrow, as collected daily or more often from the stalls. The manure-pit should always have a solid concrete bottom, and be roofed over, and every precaution should be taken to prevent liquids from penetrating the soil, for they often travel underground for a great distance, and may pollute wells supposed to be quite beyond their influence. The London by-laws relating to the construction and maintenance of receptacles for dung may be thus summarized: — 1. The capacity must not be greater than 2 cubic yards. 2. The bottom or floor must not be lower than the surface of the adjacent yard. 3. The contents must not be allowed to escape, and there must not be any soakage from the receptacle into the ground, or into the wall of the building. 4. Rain and surface water must be excluded in such a manner that the receptacle is freely ventilated into the external air. 5. If the contents are removed at least once in every forty-eight hours, the capacity may be greater than 2 cubic yards, and a metal cage may be used, the ground under the cage to be properly paved to prevent soakage into the ground, and any wall, "near to or against" which the cage is placed, to be adequately cemented to prevent soakage into the wall.

It will also be necessary to provide suitable latrines for the stable attendants. Water-closets should be used if the supply of water is abundant, but earth-closets of a good type and properly attended to are also satisfactory. If a pit, or receptacle, is required, the bottom and sides should be made water-tight, and the pit should admit of being easily and frequently cleaned.

Much advantage will be found from having at least a portion of the yard covered in, and some very comfortable yards are entirely so, but in these sufficient provision should be made for allowing a free circulation of air at the sides, care being taken, should the situation be exposed, that in high winds the air has a sufficient escape in several directions, so as to avoid any risk of the roof being lifted.

Convenient, but not too close to the coach-house doors, there should be a proper **carriage-washing stand,** arranged with a sufficient fall to a gully, Newton's medium size being very suitable. The washing-place should be not too far from the horse-washing stand, or shed, so that the hose and attachment for washing the horses can also be within reach for the carriages. Of course, if the number of horses is large, it may be desirable to have a separate water-supply and hose for the carriages. Besides the hose attachment there should be a tap at the proper height for filling buckets for the stable use, even if, as in the best stables, the water is laid on direct to each stall.

WATER-SUPPLY

In arranging for the water-supply to a stable much will depend upon the site. Town and suburban stables will generally avail themselves of the local supply, for which much storage will scarcely be needed, and the pressure will be sufficient for the hose and other purposes. In the country, however, a special supply will generally have to be provided. Rain-water is often valued for this purpose, and if it is collected from the stable roofs the cistern will have to be fixed at a suitable level below the eaves; the higher its position the greater head of pressure there will be for the discharge from the hose. The tanks, when not too large, may be of galvanized iron, but slate is very clean and durable, and for very large tanks boiler-plate iron is a strong and cheap material. Where the rain-water is used for drinking it is the better for being filtered. This need not be an elaborate affair. It should be borne in mind that the mechanical, or straining, part of filtration is now recognized as being the least efficient part of the process, and that the purification of water is now known in the main to be due to the biological work effected by microbes, and that the most efficient filtering material is that which furnishes for these the most favourable habitat. A very efficient filter for stable purposes may be formed by dividing the tank into two sections by a diaphragm reaching to within a few inches of the bottom, and placing a false bottom of perforated wood, or a galvanized-iron grating, about 6 inches above the real bottom. This grating should have a layer of not less than 12 inches of crushed coke. The water would enter the tank on one side, pass through the layer of coke and under the diaphragm, and ascend again through the layer of coke on the other side. A filter of this sort will remain in working order for a long period, and when it shows signs of clogging a slight scraping of the surface of the coke will probably re-establish its efficiency. A better arrangement would be to have the filter above the cistern, as it would not then be always water-logged, and would have full opportunities for aeration. Two filters might be provided, one being in use, and the other being laid aside for aeration or repairs.

STABLES FOR CART-HORSES

The accommodation required for cart-horses is of course of a much simpler nature than that for the carriage- or riding-horse. Not only is the horse generally of a heavier make, and of a less sensitive constitution, but he is looked upon as a unit of business that is expected to "pay

his way", and that must therefore dispense with luxury. Still more is this the case in the stables of omnibus or tramway companies, or other large commercial undertakings. Everything in these has to be contrived to combine efficiency with economy, for which, indeed, the former is, or ought to be, only another name. The space is reduced to a minimum, 5 feet being generally considered enough for the width of each stall, though for large cart- or dray-horses more ought to be allowed. Space is also often economized in the width by placing the horses back to back, with a passage in the middle. Thus, with stalls 9 feet long and a passage 7 feet wide between, and a door at the end, a stable 25 feet wide will accommodate two rows of horses. It will hardly be advisable, however, unless with doors at both ends, to have more than about eight or ten stalls on each side.

The fittings must all be of the strongest and simplest kind. Metal capping will still be the best to prevent "crib biting", but the remainder of the divisions may be of pitch pine or spruce, both being hard and tough. "Swinging bars" have been sometimes tried to give at least the pretence of greater space in the stalls; but they are not satisfactory, and with any but the quietest horses may give rise to more trouble than comfort. In places where they have been introduced they have been soon abandoned. The mangers and pots are often of glazed fire-clay, as being probably more durable than enamelled metal, and can be made with a fire-clay bar across to prevent nosing out the food. Hay-racks are often dispensed with, as chopped fodder is the custom in all these stables.

Flooring.—In the long run, square sets, though dear at first, will generally be found to make the most economical floor, and, with the general introduction of peat-litter, drainage is dispensed with. With an impervious bottom, and care in the management of the litter, and of course ample ventilation, it is surprising how sweet a crowded stable can be kept even in summer.

TRAMWAY STABLES

With practically no more harness than a trace and collar, in the case of tramway or bus stables, each horse's harness can be hung upon his own stall-post. A special harness-room, except as a store, is hardly required; but in these large stables, where the horses are counted by the hundred, a harness-repairing shop and a forge or shoeing-shop will each form a most important branch. A number of loose-boxes for horses sick or temporarily disabled, or on trial, will be very necessary. One for every eight or ten horses kept will not be too many. In stables of this size an engine and boilers to supply the power for cutting up the fodder and bruising and

mixing the corn, and in some cases for pumping water, are indispensable, and will keep a special staff of assistants in full work cutting, weighing, and filling into bags. In the passages between the various ranges of stables, strong rings should be built into the wall to secure the horses while being groomed, though a regular washing-and-grooming shed may be more convenient and offer greater facilities for inspection. All provisions for cleanliness are of even greater importance than in the gentleman's stable. The manure-pit must not be large and must have sides and bottom impervious to moisture, and the removal should be daily. In the stables of one of the best-managed tramway companies the principal walls, &c., are whitewashed monthly, and at the horses' heads every week. Lime wash is a great and cheap purifier.

In many large city stables, still further to economize space, the horses are accommodated on two stories, the upper part being reached by an inclined plane or gangway. This gangway has to be made with cross pieces of wood, well covered with gravel or litter to prevent slipping. The floor of the upper stalls is best made of steel joists and concrete, which, with the great modern facilities for the production of these articles, involves very little extra trouble or expense. Naturally a little more care will have to be taken with the ventilation and lighting of the lower story; and indeed, where possible, it is better to utilize this for subsidiary purposes, such as forges, harness-repairing, &c.

RACING STABLES

Racing stables are generally situated within convenient distance of training-grounds, as Newmarket Heath, the South Downs, &c., and are managed by trainers to whom are committed the horses of numerous owners. The separate loose-box is the universal system, and for a variety of reasons, the chief of which is the desirability of keeping apart entire horses, and the prevention of accidents to animals of great value, such as might occur in stables where, by breaking loose, the sexes could commingle, or vicious mares damage one another.

STABLE MANAGEMENT

THE IMPORTANCE OF COMPLETE SUPERVISION

In keeping horses, competent supervision is a matter of primary importance, and no real success can be relied upon without it. Where the owner has the knowledge and time, this duty will devolve upon himself; but wherever these are lacking, a competent substitute must be employed. In large studs financial and other considerations soon demonstrate the benefits of expert management, and the employment of veterinarians possessing special training and experience in stud management, as superintendents, is increasing. In smaller studs the employment of such experts is unattainable, but where the charge is placed with a natural horseman with the necessary training the best results are obtained. In many cases, however, the necessity for trained supervision is unrecognized, and any odd man with little knowledge and no natural qualification for the position undertakes the duties of horse manager. Again, no matter what the natural aptitude may be, no man is competent to exercise supervision without the knowledge which practical experience alone can give. Wherever economy with efficiency is the order, trained experience with natural aptitude must be possessed by those in control.

The man who knows a horse thoroughly in good health will be the first to recognize any departure from that condition. There is no truer saying than the old one, that "prevention is better than cure"; and the difference between success and failure depends far more than is generally recognized upon the apt appreciation of anything amiss, and the prompt employment of suitable measures to relieve it.

But besides a general knowledge, a special knowledge of the class of horse in charge is requisite. Although the natural inclination and experience possessed by one man may make him a first-class supervisor of a stud of cart-horses, he may be wholly unfitted to take charge of a stud of race-horses, and *vice versa*. But in addition to being a class specialist he should be an individualist capable of recognizing the individual capacity of each horse in his care, so that each horse may be employed in accordance with his powers. The ability to select the horse most suitable for a given purpose requires keen observation and long experience, and is even frequently of more importance than the question of technical soundness. Only those possessing the knowledge can thoroughly appreciate the delicacy of the points upon which selection has sometimes to be based. In a large stud the man who can carefully select horses most suitable for their

work is simply inestimable. As a large livery-stable proprietor remarked the other day: "It is the misfits which ruin our business".

Having a suitable horse, the next point is that he should be in fit condition; and it must be remembered that no horse can be fit for prolonged severe exertion without a requisite amount of previous exercise. The number of horses that are ruined through non-recognition of this is incredible. Many men assume that a new purchase, simply because it is new, should equal, if not surpass, similar horses in hard condition, and ignore the fact that the new horse is generally young, and frequently in no condition for hard work, for which he has to be prepared by gradually increasing daily exercise.

Grooms.—Anyone aspiring to be a groom should possess a natural love of horses, a good equable temper, and self-control, firmness, patience, and kindness. Then he should be well trained so as to understand the duties of feeding, grooming, and harnessing thoroughly, and be able to ride and drive with care, judgment, and efficiency. Ignorance and carelessness are responsible for most of the mishaps which occur both in the stable and at work. Imperfect grooming, excessive, deficient, or irregular feeding or watering, are all inimical to health. Whenever a horse is laid idle, the rations should at once undergo a decrease. A well-groomed horse is easily recognized by his cleanness, his glossy coat, and well-cared-for appearance. Evidence of undue haste in grooming, slovenliness, or carelessness is generally to be found in the unclean, untidy condition of the mane and tail. When cleaning, in addition to attention to mane and tail, any discharge about the eyes and nostrils should be carefully removed, also the skin round the anus cleaned, &c.

In addition to seeing that his horse is well groomed, it is the groom's duty to have his harness thoroughly cleaned and well fitting, and likewise to keep the stable pure, sweet, and clean, free from draughts, and of an equal temperature. Anyone when approaching a horse for any purpose, should always by word advise the horse of his intention. The omission to do this has been the cause of many accidents. The horse should never be taken by surprise; it startles and enervates him.

The old saying that "it is the pace that kills" is a very true one, and is frequently exemplified both in riding and driving. The way in which a horse is handled in saddle and in harness will, to a large extent, govern the amount he can do in either case.

Most horses, when treated intelligently, are tractable and readily obey when properly educated, and the majority of unmanageable horses are the result of ignorant or incapable handling. Occasionally, however, horses are met with which the most efficient care and handling fail to render

serviceable; indeed, some are more or less insane, and when heated or excited absolutely uncontrollable.

STABLE VICES

Habit of Eating the Bedding.—Many gross-feeding and voracious horses acquire the pernicious habit of eating their litter, but the vice is not confined to these, for horses with normal appetites in ordinary circumstances readily acquire the custom when their food-supply is unduly restricted, or when the objectionable plan of using damaged hay as litter is resorted to.

The methods of prevention are various, but, before adopting others, where damaged hay has been used its use should be discontinued, and care should always be taken to see that the food allowance is sufficient. When this is ineffectual the plan sometimes adopted is to tie the horse's head up after feeding, but a much better and equally efficacious one is the use of a muzzle. If this latter be objected to, the best remedy will be the substitution of saw-dust, peat-moss, tan, or other suitable material in place of straw as litter.

Night Kicking or Stamping in Stable.—The habit of stamping or kicking at night is a great nuisance, and not infrequently difficult or impossible to rectify. All sorts and conditions of horses are subject to it, but, as might naturally be expected, heavy horses, especially coarse, hairy-legged ones, are the most common culprits. Occasionally a horse kicks on both sides, but the majority kick only on one side.

Pruritis, or an itching sensation about the limbs, is a common cause of stamping, and in such cases the requisite applications of anti-pruritic remedies generally give relief.

In other cases no assignable cause is recognized, and despite preventive and curative efforts the habit remains. In all such circumstances the effect of a loose-box should be tried. In this and other complaints a loose-box is frequently effectual when other measures fail.

When failure follows all other methods, it is claimed that success may be achieved by adopting the use of hobbles. The hobbles are placed on a fore- and a hind-limb of opposite sides, and fixed above the knee and hock respectively, and the connecting hobble-rope is suspended through a ring attached to the lower part of a girth. But this is only to be tried as a last resort.

Tearing Clothes and Bandages.—Horses which tear their clothing are generally at rest, or their work is irregular or intermittent. Those doing hard everyday work rarely practise this annoying and expensive

habit. Various measures are adopted for its prevention, such as muzzling, tying the head up, using a cradle, attaching a rod from the stall-collar to the girth (fig. 585), or attaching a piece of strong leather to the head collar or head stall behind the jaw so that it projects a little beyond the lower lip.

Similar measures may be employed to prevent the tearing of bandages. Smearing the bandages with some bitter material may be tried, and is often effective.

Horses putting their Feet in the Manger.—When horses acquire this habit, there is often considerable difficulty in overcoming it. Mangers

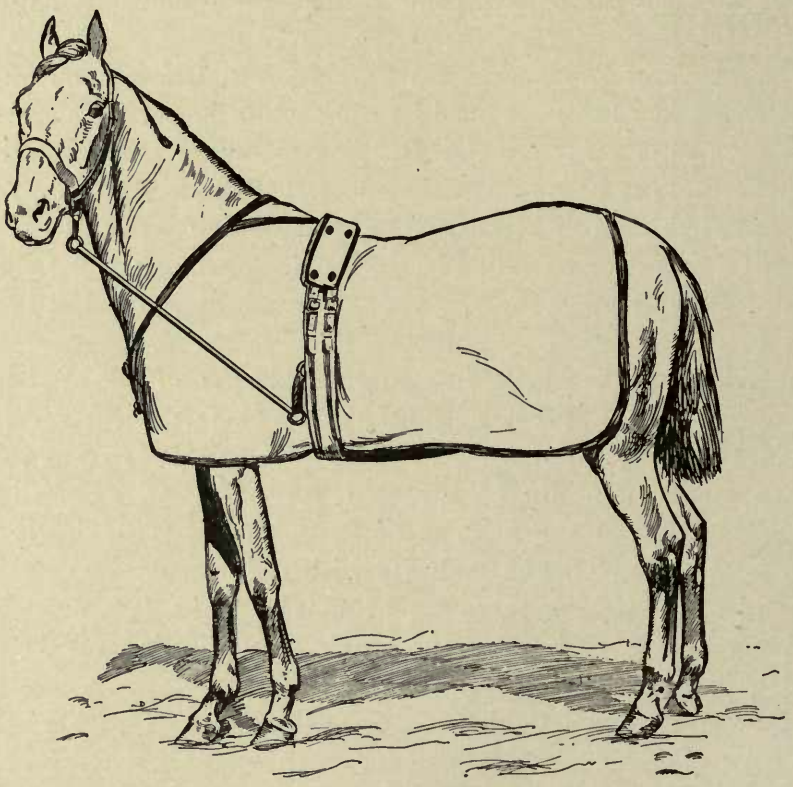


Fig. 585.—Side Rod

should be placed as high as can be reached when the horse is feeding, and, where possible, a loose-box should be used. Very few horses will persist in the habit when they are placed in a loose-box, in which the manger is fixed at a fair height.

Pawing and Scraping in Stable.—This habit, besides rendering the stable untidy, is occasionally responsible for a blemished or enlarged knee, with the resulting depreciation in value. The injury is caused by the horse striking a sharp edge of the manger. In these cases the position and shape of the manger require attention, and where attainable a loose-

box should be tried. Crocker recommends, as a "sure cure", that a weight should be suspended by a rope over a pulley on a girth and the other end of the rope attached to a hobble placed below the fore fetlock.

Lying on Elbow.—Capped elbow is an enlargement on the point of the elbow caused by the horse, when lying, pressing his elbow against the heel of the shoe. The usual preventive measure is the use of a soft pad fitted round the heel of the foot (fig. 385, Vol. II., page 360), or of a large soft pad suspended against the elbow. Another and very effectual method is to place the horse in slings for a time. After this many, when again allowed to lie down, cease to press their elbow on the shoe.

Capped Hocks.—Horses which kick or stamp in the stable are liable to injure the point of the hock, in which case a capped hock is the usual result. To prevent this, padded stall divisions, loose-boxes, and the employment of the ordinary preventive measures for stamping are the methods usually relied upon.

Crib-biting is a pernicious habit, the subject of which seizes the manger or any convenient fixed object, and makes a belching noise. The habit is usually associated with more or less digestive derangement. To prevent cribbing various kinds of neck-straps, &c., are in use. Whether one or another of these be used, none of the fittings should be such as the cribber can catch hold of, and no cribber should be permitted to remain in the same stable with non-cribbing horses. A cribber is easily recognized by the condition of his teeth.

Wind-sucking is allied to crib-biting, but here the horse does not take hold of the manger. He simply arches his neck, opens his mouth, and sucks in air. Like crib-biting it is generally accompanied by indigestion, and horses addicted to it should always be stabled alone.

FOOD

The various food-stuffs used for horse provender in these days of cheap and rapid transport are drawn from a great portion of the habitable world. This wide extension of the sources of supply has naturally led to a large increase in the kinds of food-stuffs used, and the different sorts of oats, beans, peas, maize, barley, bran, linseed, hay, &c., imported into the country are daily increasing.

The old plan of feeding with oats and hay stood the test of experience very well, but economy could not be disregarded, and in most large studs an extended and more varied bill of fare is now the custom. But it is not solely to economic considerations that this change is due. It is not difficult to understand that no single food, however admirable, can provide for a

horse's requirements in the same degree as a well-proportioned mixed food will do.

The term "mixed food" is generally used to signify a mixture of various grains with chaff.

In forming such a mixed food several points have to be considered, as no mixture can be the best for all horses under every circumstance. A food suitable for old horses may be inappropriate for young growing animals, and, generally speaking, the class of horse, his condition, his work, the season of the year, will all influence the amount and proportions of the various food ingredients.

In discussing food and feeding it is usual to give tables showing the chemical constituents of the various food-stuffs, but it is not intended to give in detail data of that kind in this section. (See, however, the chapter on Foods, page 87 of this volume). Nevertheless it may be pointed out that in employing such data, when deciding the most appropriate mixture for horses under any given circumstances, certain points must always be remembered. No comparisons can be fully relied upon between unlike substances. To accept analytical composition as a true estimate of the respective values of fodder and grain would be absurd. Their real value depends upon the constituents that are digested, and not upon their relative component constituents, and as the amount of digested constituents in any food is materially influenced by the food materials with which it is given, the necessity for knowledge in the amalgamation of food is very evident. Under the plan of feeding with oats and hay, the custom is to give a certain measure of oats and allow hay in the rack *ad libitum*; but in the more economic plan of using mixed food, a definite weight of hay is apportioned to a definite weight of mixed corn. In deciding the proportion of grain to hay it may be observed that no large bulk will compensate for defects in quality, and no concentrated mixture for deficiency in quantity. Much of the saving effected by mixed feeding has been by a partial substitution of grain for hay, and in this connection it may be remembered that a bulky food is particularly unsuitable for horses on account of the small size of the equine stomach. And when grain can be obtained at a less price per ton than hay, as is nowadays frequently the case, there is a natural inclination to increase the less expensive but more nutritious grain and reduce the more expensive and less nutritious hay; but this substitution can only be carried to a certain limit, and any attempt to go beyond this will prove disastrous.

It must not be forgotten that a too highly concentrated food is very dangerous for any horse, and particularly so for greedy feeders. These, being unsatisfied with a deficient bulk, are tempted to overgorge whenever

the opportunity occurs, and as highly concentrated cut food favours rapid mastication, gastric repletion is soon established with all its attendant evils.

On the other hand, as has been pointed out, the equine stomach is ill adapted for bulky innutritious food, and horses fed on such food are deficient in the condition and fitness requisite for long-continued and severe exertion. It is of real importance, therefore, both in the interests of efficiency and economy, to apportion accurately the weight of hay to the weight of mixed grain, as well as to decide upon the most suitable grain mixture.

Practical experience teaches that hard-worked horses will do well upon a mixture of two parts hay and three parts grain, and that it is not advisable to reduce the quantity of hay materially below this, and is uneconomical to increase it materially; but while such a mixture meets the requirements of horses doing hard work, it is an unsuitable and too rich a food for idle horses, for which a mixture of equal parts of chaff and grain will answer much better.

Chaff is simply cut hay, or cut hay mixed with a proportion of cut straw.

A very good and not too expensive chaff will be secured by mixing together two parts meadow hay, one part rye-grass and clover, and one part good oat straw.

In forming a suitable grain mixture, it should be remembered that the chief characteristic of cereals is the large percentage of carbohydrates in them, and that although oats may be used alone, both they and barley are improved by the addition of a few beans. While cereals are characterized by the large proportion of carbohydrates they contain, the percentage in maize is still greater; and therefore, while the addition of beans is beneficial with cereals, it becomes almost essential with maize.

As has been observed elsewhere, whenever a horse food is deficient in nitrogenous elements the deficiency is most easily made good by the addition of beans; and moreover beans, although so valuable in a mixture, are, in consequence of their highly nitrogenous character, altogether unsuited for use alone.

By bearing these points in mind, and by the confirmation of practical experience, a good and economical grain mixture can easily be made; and it has been established that a suitable mixture for working horses is obtained by combining two parts cereals, two parts maize, and one part beans.

Whatever plan of feeding is followed the food-stuffs used should be the best of their kind. Hay and straw should be the produce of good soils, and should be sweet, clean, well-harvested, and free from mould.

Corn should be clean, hard, dry, and sound, and old corn as a rule should be preferred to new, as it is less likely to give rise to any gastro-intestinal derangement.

Preparation of Food—Cooked Food.—It is generally conceded that horses fed on cooked food are in no respect superior, and it is even questioned whether they maintain a condition equal to that of horses fed on similar food but uncooked; and as the cost of cooking cannot be disregarded, the system of cooking horse food to any wide extent has become a thing of the past.

Feeding with Oats and Long Hay.—This plan has been in use for a long time, and on the whole has been very successful. Like other plans it has its advantages and disadvantages. Its chief disadvantage is its greater cost compared with the other methods. This arises from the higher relative price of oats and from the waste of hay which invariably occurs where hay is racked. Its chief advantage, where ordinary care is used in regulating the amount of corn given, is its comparative immunity from the production of gastro-intestinal derangements. This naturally follows from the length of time required for eating racked hay, and as a consequence the diminished liability to gastric impaction. But, as cost is an important factor in most horse establishments, this plan has very largely been replaced by the system of feeding on mixed food.

Mixed Food.—Under this regime the hay is cut into chaff, all dust being removed during the process by appropriate machinery, and the grain, after all extraneous matters are removed, is cracked but not crushed. The chaff and cracked grain are then thoroughly mixed together, and the mixture is then ready for use. The chaff is better to be fairly long than too short. Long chaff retards the process of mastication and secures additional time for gastric digestion.

When grain is crushed too fine, a certain quantity of meal is made. This gives a dusty character to the mixed food, and many horses leave the finer portions in the mangers. By thoroughly cracking all grain its thorough mastication is facilitated, and by not grinding it too fine, waste is prevented.

One great advantage attendant upon the use of mixed food is the security it gives that the grain will be thoroughly masticated. A horse cannot swallow chaff without first masticating it, and during the mastication of the chaff he of necessity masticates the grain.

System of Feeding.—All horses should be fed at least four times a day. Both on physiological and anatomical considerations, small, frequent, and regular feeding is desirable, and is certainly a more beneficial plan than giving larger quantities at longer intervals.

Where mixed food is used it is found to be a good plan to subdivide each feed into two portions.

Two-thirds of the feed should be given as the first portion, and after that has been entirely consumed, and a short interval has elapsed, the remaining portion should be given. By following this procedure it will be found that even greedy feeders proceed more leisurely with the second portion, and in doing so lessen the liability to gastric engorgement and secure more thorough digestion.

Total Amount of Food.—Heavy dray-horses require from 28 lbs. mixed food to 33 lbs. or 34 lbs., according to their size and the severity of their work, and whenever more is required it is the result of some attendant waste. About 27 lbs. or 28 lbs. of mixed food of equal parts of grain and hay will usually supply the requirements of farm horses. Tram and omnibus horses are usually allowed from 26 lbs. to 30 lbs. Other horses will require food in a corresponding ratio, according to their size and work. Horses at rest will do with a third less food than when doing severe work.

Oats.—Oats are generally looked upon as the best horse-corn, and in the light of long practical experience there is, on the whole, just grounds for that belief. No other kind of grain alone is found so well adapted for horse food under all circumstances. Whether the horse is young, or growing, or fully matured, whether he is a cart-horse or a race-horse, at work or at rest, oats can be relied upon to provide a suitable food. An explanation of this well-established fact is furnished by the chemical analysis of oats, which shows they contain the food constituents in better-balanced proportions for the horse's requirements than any other grain used for feeding purposes.

But although oats are superior to any individual grain in this respect, they are not superior to many grain mixtures, several of which may be made having the requisite feeding-constituents in better proportions than oats, and possessing the additional advantage of being cheaper. That oats form a perfect food, or for that matter any other single grain, no one will contend; even their most powerful advocates recognize that as a food for hunters and other horses during severe weather they are improved by the addition of beans. The oats on the market comprise an immense variety, of which our home supply constitutes a small proportion, the major portion being imported.

Owing to the bright appearance of many samples of damaged oats, which have been more or less successfully treated for the purpose of giving them the semblance of good ones, and to the difficulty in accurately assessing the proportion of husk to kernel in many samples, and for

various kindred reasons, much skill and experience are necessary in making a good selection. Indeed, no other horse-corn demands an equally skilled judgment in buying.

It is of very little moment whether they are black or white if they are their natural colour, thin-skinned, uniform, bright, sweet, clean, heavy, in good hard condition and thoroughly matured. All damaged oats, however mixed, bleached, or otherwise disguised, and all discoloured, musty, or dirty oats, should be avoided.

Barley.—In recent years, owing to the relatively low price of much of the imported barley, and of home-grown barley unsuitable for malting purposes, barley has been used to a considerable extent as a horse food. It is used in the form of malt, boiled barley, damped barley-meal, and in the dry, crushed state. For every-day use damped barley-meal and dry crushed barley are chiefly employed. In either way it answers very well. Many people who would not think of giving barley have been using it without realizing it. For years many samples of oats have contained a large percentage of barley. After feeding the Birmingham Corporation cart-stud with 8 lbs. barley per horse per day in place of 8 lbs. oats for a period of eighteen months, the conclusion arrived at was that, given in this amount, along with maize and beans, no real practical difference could be recognized between barley, when so used, and oats. It is frequently the most economical food on the market, the relative prices of maize and barley often alternating in this respect. Where much barley is given, the fæces of the horses fed upon it are generally rather softer in character than the fæces of those fed on oats, but the writer has failed to observe any itching condition of the skin, as is sometimes ascribed to its use.

Good feeding barley should be bright, sweet, clean, hard, and dry. Much of the imported barley contains a large proportion of dirt, and in that case it should be thoroughly cleaned before being used for horse food.

Maize.—Maize has been extensively used for many years as an article of horse food, and there are now few large studs for which it does not form a portion of the provender. Along with hay, it will maintain cart-horses in fair condition, but it is too deficient in nitrogenous constituents to form a typical horse food, and to rectify this deficiency there should always be given along with it a certain proportion of pease or beans. By giving the maize and beans in the right proportions, a mixture can be made possessing a similar nutritive ratio to oats, and this may, with impunity, be substituted for oats in the food of mature horses, but not for that of young growing animals, for which it would not possess a sufficient proportion of ash constituents.

Maize has been accused of causing grease, but such an accusation is entirely unsupported by facts, and it simply remains as a remnant of the prejudice which attended the introduction of maize as a horse food in this country.

There has only been one objection of any weight made against its use, which is that when maize is used alone, and more particularly new maize, the fæces are less firm than normal, and possess a somewhat unpleasant smell; but when old corn is combined with beans and oats, or barley, in due proportions, it gives admirable results, and the offensive character of the fæces practically disappears.

There are several varieties of maize in use, recognized by their colour, as yellow and white, and by their shape, as flat corn, large round, and small round, in addition to which each possesses a distinctive name, according to the place from which it is obtained, such as States, Galatz, La Plata, &c.

In practice we find it is immaterial which is used, providing the selected variety is old, sound, perfect corn, and so long as it has these qualities price may with impunity control the selection.

Wheat.—Owing to the low market price of wheat during the last few years, many farmers have used it largely among the horse-corn. It is undoubtedly a valuable food, but great care must be taken in using it. The marked increase it undergoes in bulk, as a result of fermentation, and the doughy character of the fermented mass, necessitates that only a small allowance be given at one time. With the view of lessening the danger of using it, many farmers damp the ground corn some time before feeding with it, and claim that by so doing they materially diminish the risk. When the price of wheat is relatively lower than other grains, many will continue to use it, but whenever its price is on a level with these, most will prefer the ordinary horse-corn.

Beans. — The beans in common use are mostly English, Egyptian, and Königsberg. English are generally preferred, and usually command a higher price, but both Königsberg and Egyptians are very extensively used, and so long as they are clean and dry it is very doubtful in practice whether any difference can be recognized in their feeding value. Old English beans are preferred to new, because they are generally harder and drier, but many people prefer new Egyptian to old, because they are less damaged by weevils, and they are as hard as the old in consequence of the washing and drying they undergo. Whatever kind is used they should be thoroughly dry, sound, and clean.

Beans are much too rich in nitrogenous constituents to be used alone, but they are most valuable in combination, and are the usual means

whereby the albuminoid ratio of foods deficient in nitrogenous matter is raised.

Pease are frequently used instead of beans. They possess a somewhat similar composition, but in using them great care should be observed to see they are thoroughly dry, otherwise they are liable to produce flatulent colic. When sound, hard, and dry, either English, Canadian, or Australian may be used with every confidence.

Indian pease are frequently mixed with the Indian vetch, or *Lathyrus sativa*, which possesses marked poisonous properties, and should never be incorporated with food.

Many deaths have been caused by its use, and many horses that do not succumb to its effects are rendered permanently useless by becoming very bad roarers.

Bran.—Bran is not now regarded as a food material in the same light as it used to be. This is partly in consequence of recent feeding experiments, and partly owing to the improved flour-mill machinery. In the first place it has been shown that a considerable portion of the nitrogenous constituents of bran is indigestible, and in the next that the improved machines, by more effectually separating the more nutritive constituents from bran, have actually lessened its value.

Many sick horses with fickle appetites will eat bran while refusing all other food, and for this purpose it is most valuable. A very useful custom for working horses is to give a bran-and-linseed mash each week, and a good one may be formed with 3 lbs. bran and 1 lb. boiled linseed.

Bran should be clean, and have a sweet smell. It should not be kept in bulk, as it is liable to heat, especially when it is made from new grain. Heated wetted bran soon becomes sour and unfit for use.

Linseed.—Linseed makes a valuable addition to mashes. It may also be given in the dry, uncrushed state, mixed with the corn. It is not given as a regular article of food, but is a beneficial addition for many hide-bound, unthrifty horses. Linseed cake is frequently used for the same purpose with much benefit. In the form of gruel, or tea, linseed is also useful in some respiratory and urinary affections.

Linseed should be clean and sweet, and free from the extraneous seeds of which many samples contain a large percentage.

Mangolds and Turnips.—These roots are given to horses during the winter and spring months. In the early spring, when horses are working hard, they relish either of these roots, and many fickle feeders are benefited by their addition to the food rations.

Where cooked food is employed the addition of a few well-boiled swede turnips sweetens the whole, and many over-worked farm-horses

in spring will readily eat food so prepared when they will not look at corn.

All roots should be well cleaned, and no unsound ones should be given.

Carrots.—No roots are so much esteemed for horses as carrots. They are too expensive to form part of the general rations for large studs, but for individual horses, with deficient appetites, and for hunters and other horses doing very severe work, or passing through an attack of sickness, they are most valuable.

Most horses are very fond of them, and many fickle feeders and invalids will eat carrots with relish after refusing their ordinary food.

They should be thoroughly sound and well cleaned before being given.

Green Food.—Many consider it advantageous to give a quantity of green food to stall-fed horses during the summer months, and when used with judicious care it is a most agreeable and beneficial, as well as an economical food. Clover, rye-grass, meadow-grass, and vetches are usually employed, and whichever is used it may be given separately, or be cut up and mixed with the ordinary mixed food.

Care should be taken to secure a regular supply of the best quality, otherwise hard-worked, highly-fed horses will rather deteriorate than improve in condition when receiving it; but the loss of condition sometimes observed may be partly due to the great reduction in the corn allowance that is frequently made when horses are on green food.

In commencing its use it is advisable to begin with a small quantity for the first day or two, and at all times it is necessary to be very careful when the green food is very succulent and newly mown, or when it is wet with dew or rain, as it is then very liable to produce flatulence and purgation.

If very succulent grass, such as is grown on water-meadows or sewage land, is given to horses on hard food, many cases of "lymphangitis", or "weed", are observed to occur when the green food is first used; indeed, more cases of lymphangitis may be seen then than at any other time.

Hay is generally considered an essential constituent in the food of stable-fed horses. It is true, no doubt, that in certain districts, when hay is short and oat-straw plentiful, many farm-horses do hard work on corn and oat-straw, but these may be deemed exceptional cases, and it will generally be considered that hay is a staple article of horse food.

The general term hay embraces several varieties differing more or less from one another. Thus rye-grass differs from meadow-hay, meadow from clover, clover from alfalfa, and so on, but if each be good of its kind their difference in feeding value is not so great as is sometimes assumed. A curious illustration of the illusory character of local opinion

respecting the feeding value of rye-grass and clover-hay and of meadow-hay is furnished in the subversive estimation of their values by Englishmen and Scotchmen. Some few years ago hay was scarce in Scotland, but plentiful in England, and in consequence a considerable quantity of meadow-hay was sent north. The Scottish owner, regarding the native rye-grass and clover as the hay par excellence, freely gave 20*s.* per ton more for it than he would give for the best transported meadow-hay. The following year hay was abundant in Scotland, but scarce in England, and a large quantity of rye-grass and clover-hay was sent south. The English horse-owner now had an opportunity of showing the converse view, and did so, for the rye-grass and clover-hay from the north never realized in the Midland markets within 20*s.* per ton of that obtained for best local meadow-hay.

Nevertheless horse-owners in general value rye-grass and clover more highly than meadow-hay, and the explanation given is that horses prefer rye-grass and clover, and do better upon it, and the point is sufficiently emphasized in the higher price usually paid. That horses eat good sound rye-grass with even a greater relish and avidity than meadow-hay is undisputed, but the reason why is probably because the former is less sustaining and satisfying than the latter. At all events, in practice we find that they consume a greater weight of rye-grass and clover than of meadow-hay to maintain a similar condition when doing the same amount of work. It has long been recognized that the value of the hay depends to a large extent upon the land on which it is grown, many farms possessing a noted reputation for the feeding properties of their produce, others having an unenviable notoriety for growing herbage of an unfeeding quality; but it is not so generally known that however much the hay grown on different soils may vary, that grown on the same soil, but cut and harvested at different stages of maturity, may vary as much—over-maturity being invariably attended by decreased nutritive value and digestibility. Again, hay exposed, during harvesting, to much rain and weather loses its natural aroma and much of its soluble matter, in which condition it is less valuable than hay made in good weather. Hay that is damp when ricked becomes mouldy, acquires a musty smell, and has injurious effects both on the digestive and respiratory system.

When succulent hay is ricked too soon, undue heat and fermentation supervene; it becomes mow-burnt, deteriorates in value, and tends to induce derangement of the digestive and urinary organs.

Good hay has a clean, bright appearance, a greenish tint, fragrant smell, crisp feel, and a tough though a flexible skin. The grasses when

cut should be in the state of inflorescence, and any seeds that have formed still adherent to the spike; they should be mainly those which grow on good soils and be free from the inferior sorts which grow on poor and wet lands. Hay that is mouldy, or much mow-burnt, must always be looked upon as inferior, however good the grasses composing it may be, and in whatever stage of maturity it may have been harvested.

Rye-grass and clover-hay should be well mixed, free from weeds, have a pleasant perfume and bright appearance, and it should be tough and flexible, with leaves and seeds unshed.

All inferior hay, such as samples that contain a large mixture of those grasses which are characteristic of poor wet soils, or hay that is over-ripe, bleached, very brittle, mouldy, bad-smelling, and highly fermented, should be rejected. At the same time it may be remembered that a small admixture of mow-burnt hay is not only not detrimental, but is distinctly beneficial, in that in small proportions it has an appetizing effect, and it seems to give to the whole a more agreeable aroma and a more palatable flavour.

New hay, although equal in nutritive value, does not seem to possess the same conditioning property as old hay, and horses fed on it are "soft", perspire more profusely, and appear more liable to digestive derangements. Notwithstanding the opinion of some very good horsemen hay does not improve by being kept several years, and the only advantage the horse-owner derives by the opportunity of buying hay several years old is that he may continue to obtain the produce of a particularly good hay season. The real gainer is the hay owner. By keeping hay for several years, and carefully watching the course of the markets, a higher price can often be secured than by yearly disposing of each year's produce.

In all large studs, and in many small ones, it is now the custom to cut the whole of the hay into chaff, and this is undoubtedly the most economical plan. Many horsemen, however, prefer giving a portion of the hay in the rack; and, when care is taken to prevent waste, this is a capital plan, especially for sick and idle horses. Invalids will frequently nibble at rack hay when they refuse to look at chaff, and idle horses have their attention occupied for a greater length of time, owing to the longer period required for masticating the uncut hay. But for hard-working horses the best plan is to cut the whole into chaff; such animals do not need a stimulus to appetite, or their attention specially occupied. What they require is food prepared so as to aid thorough digestion, and to be allowed rest as soon as they have consumed their food. A marked benefit of chaffing hay is the opportunity it affords for extracting dust, and one has

only to see the quantity of dust extracted from the best samples of hay to be thoroughly and permanently convinced of the benefits of dust-extraction.

Straw is sometimes used instead of hay, and wheat-straw is more frequently used in a chaffed condition than any other; but oat-straw is a far more nutritive fodder. The Scotch farmer knows his horses will do much better on oat-straw than wheat-straw, and the intelligent horse-owner ought to know that chaff from oat-straw is much more valuable than chaff from wheat-straw. Whenever hay is of a soft character, or is dear in price, an admixture with good bright oat-straw will be of benefit. The addition of one-quarter part oat-straw will improve the quality of the hay without appreciably lessening its nutritive value, and it will usually materially cheapen its cost.

A very good and not too expensive chaff will be secured by a mixture of two parts best meadow-hay, one part rye-grass and clover, and one part oat-straw.

Of late years a large quantity of hay has been imported, and much of the best imported hay is in practice found equal to home-grown produce.

BEDDING

The substances used for litter or bedding purposes are of considerable variety, their selection depending primarily upon the views of the horse-owner, the class of horse, the purpose for which the horse is kept, and the relative cost and supply of the various suitable materials. Wherever the health and comfort of the horse and the appearance of the stables are the primary considerations, and cost is of secondary account, straw is the substance invariably used. Horse-owners universally contend, and justly so, that clean, sweet, dry straw makes a better litter than any other material, as it entices a tired horse to lie down and rest, and it is generally more conducive to good health. Anyone possessing a real affection for his horses, and having any pride in them, will feel amply rewarded for the extra expense he incurs, by using straw for bedding, when he remembers that he is adding to the comfort and well-being of his equine friends.

Wheat-straw makes a better litter than the other straws, such as oat, barley, rye, bean, pea. It makes a good bed, is brighter-looking, tougher, and more durable, the durability being balanced when the trusses are cut in two, so that soiled ends can be removed without sacrificing the unsoiled.

Oat-straw is generally cheaper than wheat-straw, and makes a very fair bed, but it is not so bright or so durable. It possesses a disadvantage

—viewed, however, by some as an advantage—in that many horses when bedded with it eat their bedding.

Barley-straw is cheaper than either oat- or wheat-straw, but it is inferior in appearance and durability, and its use cannot be recommended on account of the annoying property, probably from the presence of barley-awns, of producing skin irritation and itching of the limbs, and thereby inducing rubbing, stamping, and kicking among horses littered with it. Rye-straw is not so irritant as barley-straw, but it is less comfortable than oat- or wheat-straw, and its limited supply and extra cost preclude its general use.

Bean- or pea-straw is, as a rule, used only on the farms where it is grown. The general custom is to give it for combined fodder and bedding purposes, the better and more digestible parts being eaten, and the inferior used as bedding.

Damaged hay is sometimes used for litter, and on farms where it is there is a difficulty in knowing what other use to put it to; but it is not a good bedding, and horses littered with it generally acquire the habit of eating their bedding, a pernicious habit which, when the hay is much damaged and mouldy, may originate serious indigestion, or even broken wind.

The quantity of straw necessary to keep a good clean bed will depend to some extent upon the stall floor and the drainage, less straw being required where the floors are evenly laid and have a slight incline from before backwards. The amount will also vary for individual horses, and horses usually require more than mares. Where there are a number of horses the average amount necessary can easily be arrived at, and with ordinary care in the management it will be found that a good bed can be maintained on 8 lbs. per horse per day, or ½ cwt. per week. For several years this quantity was allowed to a large stud under the care of the writer, and although the weight was never exceeded, but, on the contrary, the whole of it rarely used, a thoroughly good bed was always maintained. As already indicated, whenever the straw is very long it should be cut in two. If the supply of straw were unlimited, and its cost of no moment, in all probability no one would think of using any other substance; but as cost is a very important point in large studs kept for utilitarian purposes, and the supply is more or less limited, for many of these studs saw-dust, peat-moss, and other materials have been substituted.

Saw-dust.—The writer has employed saw-dust as bedding for the last eighteen years without having experienced any deleterious effects that could be ascribed to its use. It has been used solely on the grounds of economy. In large towns where there is a considerable supply of saw-dust the difference in the net cost, after making allowance for the difference in

the manure, will be 9*d.* to 1*s.* per horse per week, which in a stud of 400 horses means a sum of £800 to £1000 per annum.

Many grooms and stablemen have at first a strong objection to saw-dust; but after a time most lose this, and many seem to prefer it to straw, no doubt from the facts that it entails less work, that the coats of light-coloured horses are less liable to be stained when it is used, and that it is one of the best detergent agents for rubbing down horses' legs when muddy.

Drains are inadmissible where saw-dust or peat-moss is used, as they become blocked with dust or moss, and speedily become insanitary; but the absence of drains gives rise to no inconvenience, as the urine is readily absorbed in the dust or moss, and removed with the manure.

An objection to the use of saw-dust is based on the fact that some horses accustomed to a straw bed refuse, for a time at least, to lie down either on a saw-dust or a peat-moss bed; but this reluctance can generally be easily overcome by using at first a quantity of straw over the dust or moss, and subsequently gradually reducing the amount of straw.

A more real objection arises when horses are at rest in a loose-box, and allowed to stand on a considerable thickness of either dust or moss. There is a tendency to the generation of heat in a thick bed; and where this is allowed, the feet of any horse standing upon it for a length of time are more or less injured, the hoofs becoming brittle, hard, and dry. In the stalls of working horses the bedding is swept up against the stall divisions during the day and re-spread at night, and in this way all objectionable heat is driven away and its further production avoided. But here the injurious effect of the saw-dust upon wood, especially upon young wood, is very marked, and the wood of unprotected stall-divisions against which the dust lies is soon rotted away. This injury is easily prevented by extending the iron kicking-plate, usually attached to the stall-division, forward to the manger.

The quantity of saw-dust required to maintain a good bed is from a bag to a bag and half per horse per week.

Peat-moss.—Moss litter has been used largely as bedding. It is less costly than straw; but although its price has undergone a material reduction it is still more expensive than saw-dust.

Opinions differ very markedly as to the value of peat-moss as a bedding-material, some commending it unreservedly, others crediting it with injurious effects. At a meeting of the Midland Veterinary Association some members condemned it, and ascribed to it, more especially when used in a thick bed, the production of a condition somewhat analogous to dry rot in the hoof. Notwithstanding this, we find many practical men continuing to use it and speaking favourably of it.

In our experience saw-dust is preferable to moss. Saw-dust is both the cheaper and the cleaner material, and although the moss manure is the more valuable, this latter point is not an equivalent to the former points; besides which, saw-dust seems to have a less injurious effect on the hoof.

Mill-dust.—In some districts mill-dust is used for bedding purposes, but it has little besides its low price to recommend it. According to some authorities, horses bedded with it become infested with lice; but there are no reliable data proving that its use in any way favours the propagation of lice.

Dried bracken, in districts where it can be obtained, makes a very good, cheap, and useful bedding, but of course its use is limited to those localities where it grows.

The leaves in wooded districts are collected when dry, and when better litter is scarce or unattainable they form a useful substitute.

Sand.—At sea-side places another material sometimes used is sand. It seems to answer fairly well, and it has certainly the merit of being cheap.

HARNESS

Everyone who has charge of a horse should be thoroughly conversant with the use of every part of the harness and know how to adjust it, and every driver or rider should make it a rule before starting to see that the harness fits properly, and that every part of it is safe and sound. If this were strictly adhered to, accidents would be much fewer than they are. While all parts of the harness are of importance, some are more so than others; thus the reins and bridle are of primary importance, then come the traces, back-strap, breeching, kicking-strap, &c. At the same time every part should be of strong, light, and good material, well made, suitable for its purpose, and free from superfluities. With uncertain horses the danger of using anything but perfectly-fitting harness of best leather and workmanship is obvious, but with any horse the consequences of using defective harness may be very serious. A broken rein has led to many a runaway, and a broken breeching to many a kicking-bout.

And important as is the quality of the harness its fit is almost equally so, for a badly-fitting bridle may be a cause of bolting, a badly-fitting saddle of kicking, and a badly-fitting collar of jibbing. The necessity of perfect quality, suitability, and fit in harness cannot be too strongly urged.

Bits.—The bit is a most important part of the harness, and upon its appropriate selection and accurate adjustment much depends. Every horse should be carefully fitted with the bit most suitable for him if he is to do his work with comfort and to give his driver pleasure and his owner

satisfaction. The kind of bit required chiefly depends upon the character of the horse's mouth and his temperament, and is also largely influenced by the quality of the horseman's hands and his control of temper. The

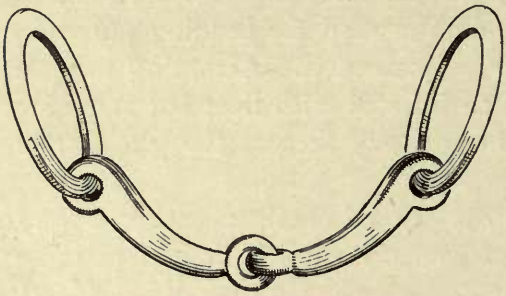


Fig. 586.—Plain and Easy Snaffle

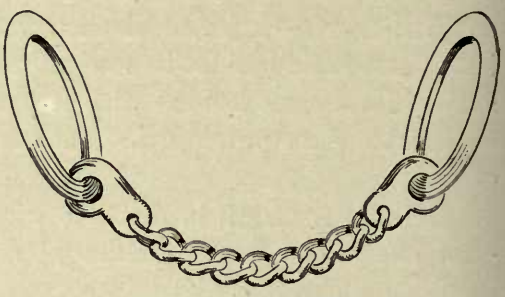


Fig. 587.—Chain Snaffle

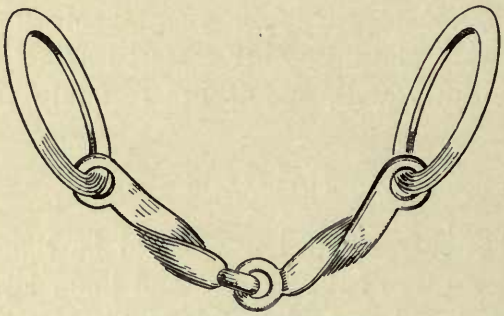


Fig. 588.—Twisted Snaffle

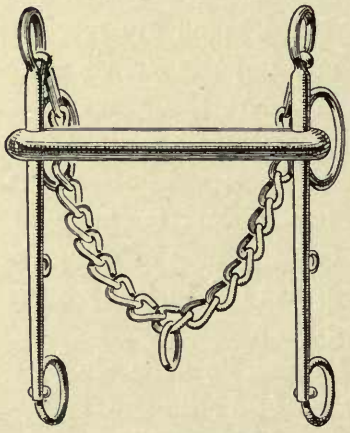


Fig. 589.—Pelham Bit

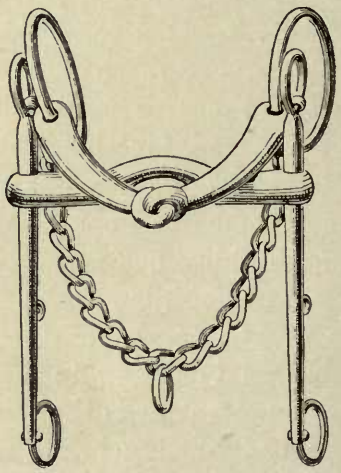


Fig. 590.—Double Bridle. The Weymouth

experienced horseman speedily recognizes when the bit is unsuitable, and takes the first opportunity to make a change, repeating this if necessary until the most suitable is obtained. Whatever kind of bit is used it should be of a width and size corresponding with the horse's mouth, and should be

adjusted to hang free in the mouth just below the angles, which should not be compressed by it. Many horses go best in a snaffle, and for these there is a wide range for selection, from the plain and easy snaffle (fig. 586) to the twisted snaffle (fig. 588) and the powerful chain (fig. 587). Others are better suited by a curb bit, as the Pelham (fig. 589), or by a double bridle, as the Weymouth (fig. 590), each of which may be easy or punishing, according to the mouth-piece, the length of the cheek-bars, and the adjustment of the curb. The easiest bit is the plain snaffle. The guard-bit, with revolving mouth-piece (fig. 591), is also a very humane bit, and by many preferred to the Liverpool sliding-bit (fig. 592).

The advantage of good "hands" cannot be too strongly insisted upon.

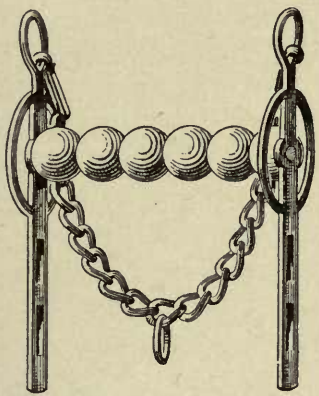


Fig. 591.—Guard Bit

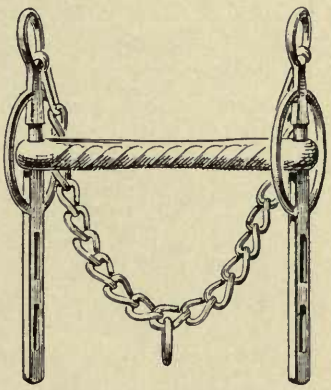


Fig. 592.—Liverpool Bit

Many a puller has been made, and many a high-spirited horse spoiled, by the irritation of a heavy, unsympathetic, uncultivated hand.

Bearing-reins.—The question of bearing-reins is a somewhat thorny one. As frequently used the bearing-rein is undoubtedly an instrument of punishment. Recognizing this, many humane people have in unsparing language denounced its use under any circumstances. Notwithstanding this, the bearing-rein, when properly adjusted, is of great benefit in restraining fresh, hard-pulling horses; it makes them go better together, keeps them better in hand, and saves the driver many an arm-ache and the owner the costs of many an accident. As an aid in controlling restive horses it is unquestionably much less chafing, more serviceable, and more humane than its secret substitute the gag-bit.

Every horseman who has to handle high-spirited, well-bred, well-fed, intermittingly worked horses can appreciate the great value of a properly adjusted bearing-rein. While its abuse deserves the condemnation of every humane person, its rational use can only be condemned by those ignorant of its benefits.

CLIPPING AND SINGEING

The relief which horses, especially those doing fast work, experience by the removal of their coats in winter is so manifest to every horseman that any argument in favour of the procedure, or in defence of it, is wholly unnecessary. The old method of clipping by hand-scissors and subsequently singeing was years ago discarded for the hand-clipping machine, and in its turn the latter is rapidly being replaced by more expeditious and better-working clippers constructed on the principle of the sheep-shearing machine. (See fig. 487, page 137 of this volume). The singeing-lamp, formerly so frequently and often ignorantly used after the hand-scissors, is almost unnecessary after the improved clipper, and is now used chiefly for the removal of long coarse hair from unclipped parts. All horses with thick coats, doing fast work, should be clipped during the winter months, and in the majority of cases two clippings are necessary, the first about the beginning of October, the second about Christmas.

In harness-horses the coat is removed all over the body, but in saddle-horses it is usually left on the saddle-seat and on the limbs, saddle-galls and mud fever being less frequent in the unclipped than the clipped.

While clipping is so beneficial for horses doing fast work, it is not found to answer so well in the case of horses that do slow work and have to stand about in cold weather, such as cart-horses when their carts are being loaded and unloaded. Clipped horses so exposed are frequently the subjects of chills, colds, &c.

In these cases, for the purpose of securing as far as possible the benefits of clipping while avoiding its disadvantages, two methods have been adopted—the one chiefly in Scotland, the other in England. The Scottish plan is to clip the horse half-way up, and to leave the upper surface intact. The English plan, which is the better one, is to singe the whole surface, but in a graduated manner, so that while the most of the hair is singed off the under surface of the abdomen, a fair coating is left over the back and loins. Anyone using the singeing-lamp for the first time, whether on the clipped or unclipped surface, must be careful, especially on the under surface of the abdomen, not to bare the skin. One of the worst cases of erysipelas the writer has witnessed occurred as a sequel to an excessive use of the singeing-lamp on a previously-clipped surface.

VENTILATION OF STABLES

Adequate stable ventilation is nowadays recognized as essential for the maintenance of good health in the stud. No horse can be thoroughly well or fit, or in condition to do hard work or to resist disease, that is condemned to inhale the impure air of a badly-ventilated stable. When the inspired air is charged with equine exhalations, oxidation of the blood is lessened, elimination of impurities from the body is retarded, the system becomes loaded with waste products, and the vital force is markedly lowered. The visible results are that horses so housed become languid, easily fatigued, and show a marked tendency to succumb when attacked by any serious disease.

If horses are to be kept in good health the air they breathe must be pure, hence the necessity for ventilation, or, in other words, the extraction of impure air and the introduction of fresh air. This exchange requires to be done without unduly lowering the temperature or creating draughts, and it should be constant and regular. With the view of best securing this, many plans have been tried, but their efficacy depends on many extraneous circumstances, such as, *e.g.*, the season of the year, the position of the stable, its size, &c. The inlets and outlets require to be much greater in hot than in cold weather, and in confined, closely-inhabited town positions than in thinly-populated exposed country districts. Regulation of temperature and prevention of draughts are more easily secured in small than large stables; and as the spread of infectious and contageous diseases takes place more readily in stables where large numbers of animals are kept, the majority of horse-owners are beginning to recognize the advantages of small over large stables. The entrance of fresh air is usually arranged for by means of gratings, and by tubes in the walls, by the doors, and by specially-constructed windows. The exits generally consist of extraction-shafts, patent cowls, gratings, windows, and louvred arrangements. But whatever plan of inlet and outlet is employed the former should be fairly low down and so placed as to avoid projecting draughts on any of the horses, and the latter should be high up in the building. The old principle of low inlet and high outlet is correct, and, when followed, a more thorough exchange of air is secured than when both inlet and outlet are placed on nearly the same level, for in the latter case the lower stratum of air surrounding the horses remains practically unchanged.

Likewise, whatever plan of exit and entrance is used, there should always be provision for regulating the size of the ventilators according to

requirements, and due care should be taken that their proper adjustment be systematically attended to. The necessity for this will be fully apparent when it is remembered how much smaller apertures suffice for half-filled stables during cold windy weather than for well-filled stables during hot sultry weather.

TEMPERATURE OF STABLES

The temperature of the stable is another matter of primary importance. Its influence in modifying the horse's coat is thoroughly appreciated and taken advantage of by horse-dealers and grooms. They systematically keep the temperature too high, as well as employ a complete covering of rugs and bandages, for the purpose of improving the appearance of their horses' coats. The injurious effects of this are clearly seen in the frequency with which newly-purchased horses suffer from cold, &c., when subjected to ordinary treatment.

A marked example of the influence of temperature is exhibited by pit-studs. During the first winter they are in the pit the majority require to be clipped, but in succeeding years clipping is unnecessary, for, owing to the slightly higher and more even temperature of the pit, most horses acquire very fine coats.

Another striking illustration of the effects of high temperature, but of an injurious character, is occasionally furnished by horses that have been left out at grass late in the autumn. When these horses are brought in and stabled in warm stables, they, owing to their heavy coats and the sudden change of temperature, perspire profusely, and, as their heavy coats do not dry readily, a subsequent chill with pneumonic trouble not unfrequently supervenes. Whenever such horses are brought up from grass they should be housed in cool stables.

The stable temperature should range from 50° to 60° Fahr., according to the time of year, the class of horse, and the work he has to do.

EXAMINATION OF HORSES AS TO SOUNDNESS

SECTION IX.—EXAMINATION OF HORSES AS TO SOUNDNESS

INTRODUCTORY

The examination of horses as to soundness is a difficult and in many instances an unthankful task, even to the expert veterinarian. Yet many horsemen outside the professional element undertake it, and in a certain measure succeed. By long experience they are enabled to recognize the grosser organic defects and their consequences which appear on the surface, and their familiarity with the normal action renders any serious disturbance in this respect a noticeable object. Even those less informed and with no experience to guide them venture to undertake the responsibility, and sometimes by a stroke of luck without suffering loss, but in the majority of cases to find that their self-reliance has played them false and landed them in a more or less costly difficulty which is too often rendered still more so by the interposition of the solicitor, maybe the learned counsel and the court.

It is not to be expected that anything which we may write will imbue lay eyes, lay fingers, and the lay mind with that co-ordinated intelligence which the qualified veterinarian possesses, and for this reason alone it is always desirable that the one should seek the assistance of the other when the question of soundness is involved.

What we are about to say, therefore, as to the examination of horses is not with any idea of encouraging the horse-buyer to disregard this common duty to himself, but rather to show him how great are the difficulties in the way of its successful performance, and to assist those who are beyond the reach of veterinary aid, or who have not the means to procure it; also to help others who, while recognizing a defect, fail to interpret its effect on the value and utility of the animal.

The important questions involved in the examination of horses are:—

1. Does the animal present any appearance to indicate the existence of disease or its effects?

2. Assuming one or both of these to exist, to what extent, if at all, do they interfere, or are they likely to interfere, with the services of the animal and to depreciate his value?

Many animals show obvious effects of disease yet are not one whit the worse for it.

Some while actually suffering from disease are still capable of performing a considerable amount of work without inducing pain, and, although unsound, are in a certain measure useful.

That form of bony growth on the legs of horses termed "splint" exists almost universally, and in a very large majority of cases the animals so affected pass through life without suffering inconvenience from it after it has formed, and sometimes even when it is of very considerable size; and the same may be said of some other bone tumours.

A horse having a cataract in his eye would be legally unsound, but for certain purposes might be as serviceable as one whose eyes were of crystal brightness. Numerous other cases of the kind might be adduced, but these will suffice to illustrate what the writer wishes to convey.

The other class of cases, where serviceableness becomes possible during the existence of actual disease, finds its best illustration in that affection of the breathing organs termed roaring and whistling, in which certain of the muscles, whose office it is to open the entrance to the windpipe, undergo a slowly progressive wasting, during which their action becomes impaired and the free entrance of air to the lung hindered. Here, however, sooner or later work becomes impossible, and the useful animal becomes useless.

As to whether a horse is "sound" or not is quite beyond the powers of the most able and experienced veterinarian to say. The most he can do is to affirm the absence of any outward visible signs of unsoundness, but so differently are phenomena interpreted by different individuals that even here he is frequently met by contradiction from his equally able confrères.

PRELIMINARY OBSERVATIONS

In proceeding to examine a horse as to soundness, there are certain observations which require to be made before the animal is removed from his stall or box, or in any way interfered with, and it is always desirable during this time to note the general state of the box itself.

The posture or position in which the horse habitually stands may be of the first importance in directing the course of enquiry, and should be carefully observed. In this connection some regard will be paid to the manner in which the horse disposes of the weight on his limbs. One fore-foot habitually in advance of the other, although not necessarily

indicating lameness, is nevertheless a posture almost invariably assumed where disease exists in the foot, and sometimes also in the course of the leg. If the feet be alternately advanced and withdrawn, the animal first resting one and then the other at frequent intervals, or if, as it is said, the horse "points" his feet, both will require to receive special attention in the course of the examination, since this change of attitude, or "pointing" of the feet as it is termed, may imply some defect in both.

Similar observations require to be made with regard to the hind-limbs, and any habitual tendency to rest one more than the other should be a matter for further enquiry. Horses suffering from spavin stand with the hock flexed and the weight removed from the limb, and when moved over from side to side a halt in the gait will be evinced.

If the horse's head is tied up short to the rack it should be let down. The crib, however, will be more or less frayed if he has been in the habit of biting it, and the partitions and stall-posts will reveal any propensity to kick in the stable, as some horses do. This, of course, is a vice, but the purchaser should not overlook anything that is likely to interfere with the horse's well-being, and the act of kicking in the stable not only tends to bring about injury to his legs but to damage the stable fittings and give annoyance to the grooms.

It sometimes occurs that stringhalt will reveal itself in moving a horse over in his stall, or turning him in a narrow box, when it cannot be provoked in the open.

EXAMINATION OF THE EYES, NOSE, AND MOUTH

Having proceeded so far, a snaffle-bridle may now be put on and the horse's head brought round to the door, where a careful examination of his eyes and their appendages should be made. Before, however, proceeding with this branch of the inspection, the examiner should assure himself as to the suitability of the light. A door facing an open space is the most suited to the purpose, so long as it is not exposed to bright sunlight. Too much light falling upon the eyes causes the pupils to contract, and the crystalline lens, which is of special importance to the enquiry, to be hidden from view. Having provided a suitable light, the form and disposition of the eyelids should first be noted. When paralysed they droop and give the eye a closed appearance, but another condition affecting them is that resulting from repeated attacks of specific ophthalmia, when the upper eyelid, instead of describing a graceful arch over the globe, is drawn up into an angular condition, as shown in Fig. 593. Of course the *haw*, or third eyelid—a thin triangular piece of cartilage in the

inner angle of the eye,—should be present and free from any abnormal growth or thickening of its investing mucous membrane. A good view of it may be obtained by pressing the eyelid backward under the orbit, as shown in Fig. 594.

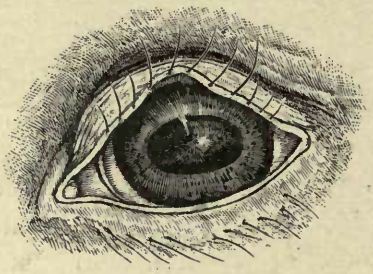


Fig. 593.—Recurrent Ophthalmia

Eye showing an angular condition of the upper lid the result of a succession of attacks of Specific Ophthalmia.

A general examination of the eye itself must now be made, first by comparing the one with the other as to size. Wasting of the eye-ball is a common result of constitutional ophthalmia, and is attended with that angular condition of the upper eyelid referred to above, as well as a more or less sunken state of the globe and textural alterations within it.

As to matter of form, the normal condition of the eyes should be full and bold, and describe a regular convexity in front without there being any observable difference between them.

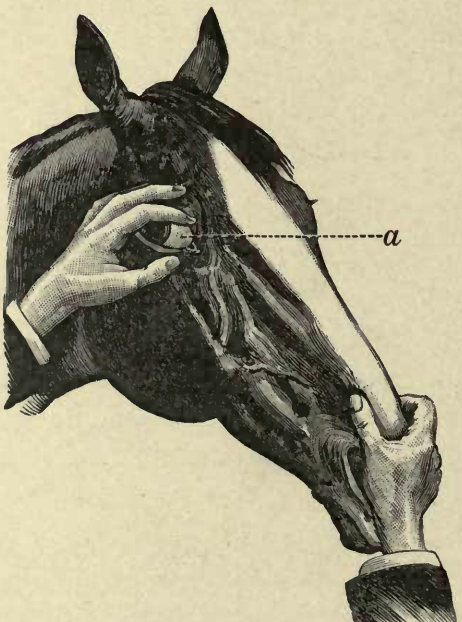


Fig. 594.—Examination of the Eye (*a*, the Haw)

Eyes too prominent, although perfectly clear, sometimes result from paralysis of the optic nerve, in which case vision is more or less defective or altogether lost. Undue flatness of the cornea or front of the eye is also a condition in which sight is impaired, and would, like the other defects referred to, constitute unsoundness.

In order that objects may be clearly visible, the passage of light to the optic nerve should be uninterrupted by any cloudiness or opacity of the ordinarily transparent structures.

In this connection it will be necessary to examine not only the surface, but also the interior of the eye—the cornea, or surface, for opacities of various forms and densities, and the interior for these and other defects. Opacities on the surface are much more serious when in the centre than when near the circumference. They not uncommonly assume the form of pale milky streaks across the eye, such as are inflicted by the lash of a whip, and sometimes so faint as to be of no importance. On the

other hand, they may be very dense and interfere with the function of vision. Sometimes these opacities are presented as white spots, small or large according to the nature and extent of the disease which produced them. Such examples are serious, and unquestionably constitute unsoundness.

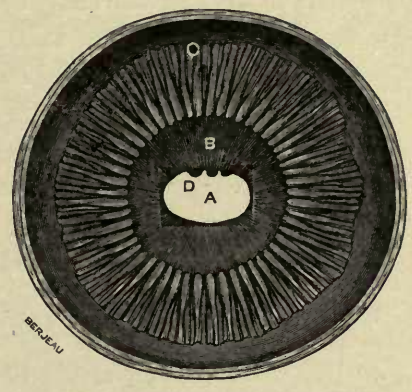


Fig. 595.—Interior View of the Eye

A, Pupil. B, Iris. C, Ciliary Processes. D, Corpora Nigra.

While these observations are being made as to the condition of the cornea or superficial coat of the eye, it will be necessary to note whether the pupil contracts when the eye is exposed to light, and dilates when its influence is withdrawn. The latter condition may be produced by covering the eye with the hat for three or four minutes, when the pupil should dilate and contract again when exposed to light. If it is found to remain widely dilated, with no disposition to contract, or to contract feebly and imperfectly, either the light is not reaching the optic nerve, or the nerve or the iris itself is diseased. In such a case the animal is clearly unsound.

To those unaccustomed to the examination of eyes the appearance of the *corpora nigra* (fig. 595) may cause some confusion. These are ordinarily small black bodies attached to the margin of the iris, but in some instances which have come to the writer's notice they have become so far developed as to hang over the pupil as large black masses, and while doing so obstructing the ingress of light and thus impairing vision.

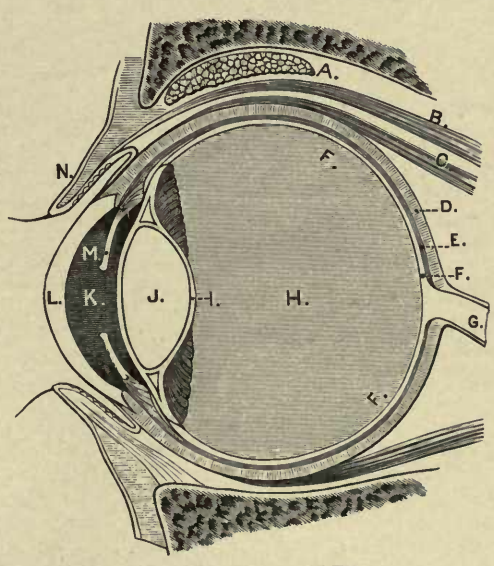


Fig. 596.—Section of Eye

A, Lachrymal Gland. B, Levator Palpebræ Superioris. C, Levator Oculi. D, Sclerotic Coat. E, Choroid Coat. F, Retina. G, Optic Nerve. H, Vitreous Humour. I, Capsule of the Lens. J, Crystalline Lens. K, Aqueous Humour. L, Cornea. M, Iris. N, Upper Eyelid.

The crystalline lens (J, fig. 596), enclosed in its capsule and placed behind the pupil, will now come under observation. In a normal condition both these structures are perfectly clear and transparent, but under circumstances of disease dense opaque spots, varying from the size of a pin's point to that of a pea, or a diffused opacity,

appear, and these constitute the disease termed cataract (Vol. II, p. 119).

The larger and denser of such developments are readily detected, but the smaller formations only become visible when carefully sought for.

To detect these more minute opacities the eye requires to be viewed in a slanting direction while a dark shadow is thrown over it.

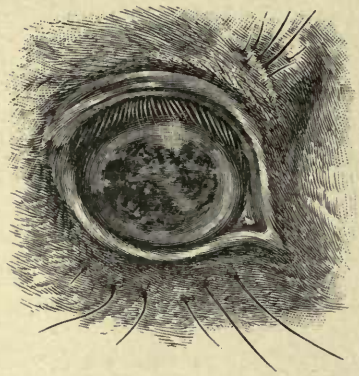


Fig. 597.—Cloudy Cataract

Standing at the right side of the horse's head, while still at the door, the examiner seizes the cheek of the bridle with the left hand, and with the right brings his hat, or other black surface, opposite the eye, and within a few inches of it. He then pushes the nose slightly away from him, when, by looking into the eye in an oblique direction from the right forward towards the left, he may see the lens and critically examine it. Anything in the form of a cataract will then be noticed either as a sharply circumscribed white spot (fig. 256, Vol. II, p. 119) or as a diffused cloudiness (fig. 597) of the lens, or its capsule, or both. The right eye having been examined, the left is then submitted to the same line of inspection.

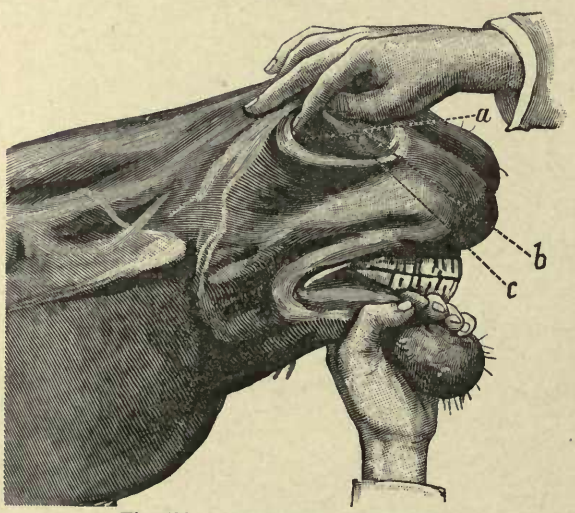


Fig. 598.—Examination of the Nostril

a, True Nostril. *b*, False Nostril. *c*, Nasal Duct.

Where deep-seated mischief is suspected, *i.e.* disease of structures behind the lens, the use of the ophthalmoscope may become necessary to bring it under observation.

EXAMINATION OF THE HEAD

Carrying the eye down the face, the examiner should look for enlargements in the region of the jaws from disordered teeth and other causes.

The nostrils should then be dilated with the finger and thumb as shown in fig. 598, and the interior examined as far as the eye can see. The natural colour of the lining membrane is of a uniformly pale-pink hue, which in certain diseases becomes seriously changed. In glanders

the membrane assumes a bluish, or dark slatey hue, and may present one or more red elevated pimples, or ulcers, or, where the latter have healed, white irregular scars. Thickening of the membrane from other causes, or polypi, may also exist here and interfere with the entrance of air into the lungs. Disease of the nostril is usually associated with more or less enlargement of the lymphatic gland (submaxillary), situated on the inner side of the lower jaw (fig. 77, Vol. I), which is readily accessible to the fingers, and should always be examined. Any discharge

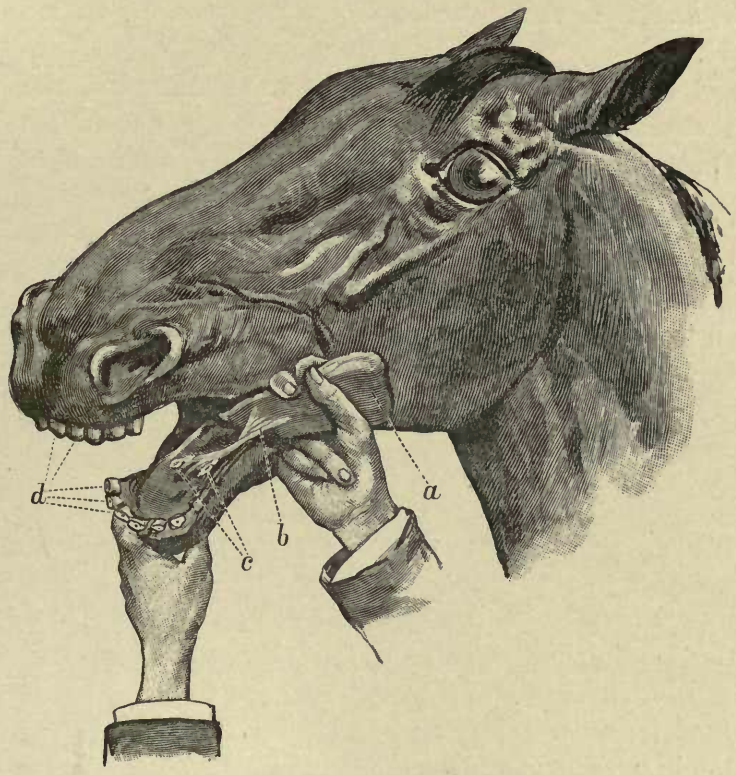


Fig. 599.—Examination of the Mouth

a, Tongue; *b*, frœnum; *c c*, openings of the salivary ducts; *d*, teeth.

from the nostril should be regarded with suspicion, and if resulting from a cold, or some abiding cause, or if associated with tumefaction of the gland referred to above, would constitute unsoundness.

To avoid error it may be necessary to point out that on the floor of the nostril, a little way within it, and at the line where the skin joins the mucous membrane, a small round hole appears. This is a natural formation—the outlet of a duct, by which any excess of tears is conveyed from the eye (*c*, fig. 598). We call attention to it because it has sometimes been regarded as an ulcer.

Before leaving the facial region, the examiner should open the mouth

widely as shown in fig. 599. This affords an opportunity to decide upon: 1, the age; 2, as to whether the teeth show any excess or deficiency in number; 3, any irregularity in their growth, distribution, or direction; 4, any disease. A horse whose teeth are so situated, or directed, or exist in such number or condition as to interfere with his feeding, is unsound.

The tongue should be free from disease, and the lower jaw, between the tush and the grinders, needs careful attention, as here serious damage is sometimes done with the bit, causing abscess and sloughing of a portion of the bone, a state of things which unfits the horse for work and renders him unsound.

The hand should now be passed along the sides and under part of the throat, over the poll and the withers. The glands of the throat may show enlargement left as the result of cold, influenza, or strangles. The poll, or the withers, may be enlarged and tender from a forming abscess, or from a declining fistula.

It sometimes occurs that the jugular vein becomes blocked as the result of injury inflicted upon it by bleeding. If pressure is made upon the vessel in the middle of the neck groove, and the flow of blood from the head be interrupted, the vein in a normal state will become filled out and distended, but if obliterated, or spoilt, will undergo no change above the seat of pressure.

GENERAL EXAMINATION

The horse may now be led out, and, while standing perfectly quiet, subjected to a careful inspection as to any alteration of form from accident or disease. In this connection he will require to stand on level ground and be viewed from all points and in all his various parts; from below, from behind, in profile and diagonally, as well as from the front.

Viewed from the front the feet should be compared, to see whether they are alike, or if one is smaller than the other, or whether there is or is not some defect of formation, or a shelly or weak condition of the hoof, or sandcrack.

Carrying the eye upward along the course of the legs the observations to be made here should be concerned in the first place with their direction —are they straight, or does the animal knuckle over at the fetlocks, or stand over at the knees? do the joints show signs of wear or enlargement, or the muscles of the shoulder an appearance of wasting?

Looking back in the line of the quarters the examiner should note whether the hips are intact, or whether one has been broken ("Hip down").

Any scars or abrasions on the knees will also be noticed at this time.

A side view will tend to confirm or refute some of the conclusions formed from the front aspect, and, in addition, it will enable the examiner to judge as to the normal or abnormal condition of the breathing. He should, while here, examine the back for sores, the belly for rupture, and the groin for scirrhous cord. The presence of this last condition is sometimes marked by a discharge which gathers on the inner surface of the thigh, and always by a hard enlargement in the scrotum. In stallions occasionally, and less frequently in geldings, hernia in the scrotum, or purse, may exist, and will be recognized by a fluctuating enlargement in the groin. Other enlargements sometimes occur in the scrotum of the stallion, the result of disease, such as varicose veins, or the presence of fluid, as in hydrocele. A horse having any of these defects would of course be unsound.

The side view should now be extended to the quarters, taking in the hind-limb. Any appearance of "down at the hip" may now be confirmed by manipulation of the part. If this defect be found to exist, the question to be decided is whether the breakage and displacement of the bone is such as to cause lameness or interfere with the horse's services. To a hack or harness-horse it might not be of any consequence, but in the case of a hunter, or race-horse, any considerable fracture and displacement would constitute unsoundness. From this point of view, too, the tail will come under inspection. Sometimes this organ is paralysed and hangs loose and limp, and is altogether incapable of voluntary movement. In these cases the sphincter ani, or round muscle, which ordinarily prevents the escape of the fæces from the bowels, is also involved, and fails to perform its function. Such a state of the parts is essentially one of unsoundness, and the same may be said of an animal recently docked, when, as a result, he becomes the subject of tetanus.

Carrying the eye downwards, the examiner should notice the direction of the limb and should keep in view any defect of conformation, rendering brushing or other injury during action possible. From this point the presence or absence of curbs, and any enlargements about the joints, or in the course of the bones, tendons, or ligaments, will be noted, to be confirmed later by manipulation of the parts. The same observations as were made in respect to the fore-feet should be repeated on the hind ones.

Viewed from behind, the symmetry of the two quarters should first be criticized. It sometimes happens that from various causes the muscles of one side of the croup are wasted. The existence of such a state may be associated with spavin of the same limb, or with some other disease which has caused the muscles of the quarter to be thrown more or less out of use during its existence.

ERUPTIVE DISEASES

While this course is being gone through, any eruption on the skin, or warts, tumours, or scars resulting from their removal, will come under notice. Pimples and nodules on the skin of grey horses, especially in the region of the flank, about the sheath, perineum, or anus, are always suggestive of a form of growth (melanosis) of a malignant character. Eruptions behind the knees and in the bend of the hocks, termed respectively "mallenders" and "sallanders", interfere with action, and sometimes altogether unfit the horse for work, in which case they constitute an unsoundness; and the same may be said with regard to the disease termed "grease", and all other eruptions when occurring on parts of the body where they will interfere with the animal's services.

ACTION

We may now direct our attention to the horse's action, for which purpose he should first be made to walk about 50 yards backwards and forwards, with his head as free and unrestrained as it can possibly be allowed. The common practice of taking hold of the bridle close to the bit, and forcing up the head, as usually adopted by the expert nagsman, adds very considerably to the difficulty of forming a diagnosis in the slighter forms of lameness, and may be the means of causing them to be altogether overlooked. The animal may now be turned short round from right to left, and from left to right, and then caused to move in a backward direction. During this test it will be noticed whether the action is close, and such as to cause brushing, or interfering, and whether there are any indications of *stringhalt* or *shivering*. The former will be indicated by a spasmodic upward jerk in one or both hind limbs—rarely it may occur in the fore ones—while the latter is recognized by a difficulty in backing, during which the muscles of the quarter and the tail are thrown into a tremulous condition (fig. 533). Although both these affections constitute unsoundness, it must be borne in mind that animals that suffer from them are generally capable of performing a considerable amount of useful work; and further, that either of them may exist in such an incipient condition as only to be perceived on rare occasions. It cannot therefore be said that because a horse does not exhibit signs of their presence at the time of the examination he is necessarily free from them.

Lameness when present is not always developed by walking, but may only appear in the faster paces, and even then it may not be

displayed until weight is placed on the back. It is therefore necessary to a thorough examination that the horse be trotted for 50 yards in hand backwards and forwards on a loose rein, at an easy pace, and then again under saddle, first on soft ground and then on hard. While this is going on, his movements should be carefully criticized, both as to the natural action, which may be close and "brushing", as well as to the presence of actual lameness.

There is an idea in the minds of some that where lameness exists the affected animal "drops" on the lame limb, but, as matter of fact, the reverse is the case. When the unsound leg is on the ground the head is elevated, in order that the muscles may relieve it of a certain amount of weight, and when the sound limb meets the ground the head "drops" with it. The same kind of movement is observed where lameness occurs behind. It is well known that lameness is aggravated when passing from soft to hard ground, and some veterinarians have regarded this phenomenon as indicating the foot as the seat of trouble. Our experience is, that when the cause of lameness is in the foot the difference in the intensity of lameness in passing from the softer to the harder surface is greater than when the cause is elsewhere, but we do not consider that the test is of any diagnostic value.

DEFECTS OF CONFORMATION AND DEFORMITIES

There are certain defects of conformation which, if they are not themselves unsoundness, sooner or later lead to it when existing in a pronounced form, and the examiner must be on his guard in respect to the amount of licence he permits in them. Among these, turned-out toes is in certain instances a fruitful source of trouble, and especially when the pasterns are long and the horse is narrow in front; and the defect is still further fraught with mischief when the feet are large. Brushing, cutting, and interfering are the common consequences of this form of development. If the out-turn of the feet is not considerable, and the pasterns not too long and sloping, and at the same time there is an absence of any marks of brushing, no serious importance may attach to it, and especially if the horse has been in regular work. When, however, in these cases the animal is wearing a feather-edged shoe and the inner quarter of the foot has been rasped away, there is ground for suspecting that the horse is in the habit of brushing when undefended by these artificial means.

Legs bent over at the knee, "knee-sprung", or that form in which the bend is forward at the knee, is another very common defect of conforma-

tion more particularly seen in our thoroughbreds. This is very frequently congenital and hereditary, in which case a slight forward inclination is of no importance, and we have known horses whose knees were very much flexed to pass through a life of hard work without displaying the slightest inconvenience from them.

But this defect is very frequently acquired by accident or hard work. It may be that no very obvious changes in the textures of the leg are to be found, but with the majority it is otherwise. Bursal enlargements, sprains and contractions of tendons and ligaments behind the limb, bony enlargements behind and below the knee, are the most common among the causes of this defect, and all of them constitute unsoundness.

EXAMINATION OF THE LEGS AND FEET

We have now reached a stage where it becomes necessary to subject the legs to careful manipulation in search of defects which may not hitherto have been patent.

Capped elbow (Vol. II, p. 359) will, of course, be perceptible at a glance. It is of varying importance. Sometimes, when of recent formation, and attended with inflammation and lameness, it would constitute unsoundness, but after the inflammatory action has subsided it becomes merely an eye-sore, unless of course it is large and specially liable to injury from the cause which produced it. Before proceeding down the limb the finger should be directed to the seat of median neurectomy (p. 165 of this volume), when evidence of the kind referred to in connection with other neurectomies may be discovered (see Fetlock, p. 377).

As we pass down the leg we may meet with sprain or rheumatism affecting the muscles of the arm, and the only evidence of it then present may be a tenderness to pressure along their course with more or less lameness. The writer has in mind the case of a horse which he knew went sound on one day, and was quite lame from this cause on the next.

The Knee.—Passing on to the knee, we first survey the front and feel for any enlargement of the surface, or for a nodule beneath the skin not uncommon in hunters from an embedded thorn; the hair should be raised in order to expose any scar, the result of a former broken knee. Scars here do not render a horse unsound, unless the cause which produced them has also affected the joints or structures about it in such manner as to interfere with the animal's action and usefulness.

The Canon.—Carrying the hand down the front of the canon, one not unfrequently finds here in young thoroughbreds soreness, with bony deposit (sore shins), which is distinctly an unsoundness.

As the hand travels along, the tips of the fingers should be made to grip lightly the inner splint-bone and its connection with the canon in search of splints, which will be recognized as small nodosities or lumps either upon the splint-bone or at its junction with the canon. As to whether a splint is an unsoundness, this will depend upon a variety of circumstances; but it is well to understand that it is not necessarily so, or, in other words, that a horse may have a splint and yet be in a legal sense sound. If, however, it should cause lameness at the time, or be in such a position, or of such a size, or of such a form as to do so in the future, the horse would be unsound. The most objectionable position in which a splint can form is at the upper part of the canon, behind and below the knee, where it is bound to encroach upon and interfere with the suspensory ligament. A large splint behind the leg in any position may do the same, or even encroach upon the flexor tendons, where a small one might be perfectly harmless. A small sharp-pointed or asperous splint is more likely to injure parts contiguous with it than one having a round, smooth surface. Further, a splint may be quite out of the way of all tendons and ligaments, but of such a size and in such a position as to render it liable to be struck by the opposite limb. It is, therefore, of the first importance that these points be well considered in carrying on an examination of this region. It should, moreover, be kept in mind that splints, which, by virtue of one or another of these forms, are very objectionable in young animals, are much less so in older ones, where the parts about the splint have by time accommodated themselves to the encroachment of the bony growth.

The Fetlock.—Approaching the fetlock-joint, the examiner will note whether or not the animal has been "unnerved". Evidence of the operation should be sought on either side of the limb a little in front of the back tendons and about 3 inches above the joint (high operation), or in the same situation midway between the fetlock and the coronet (low operation). (See pp. 161–166 of this volume.) Here the scars resulting from the incisions will be found attended with more or less thickening of the skin, and the divided ends of the nerves will be felt as small nodules beneath the skin. If the skin of the heel be pricked with a pin there will be no flinching, the division of the nerves having deprived the part of all sensibility.

In passing the hand over the fetlock-joint the examiner will recognize any enlargement in front, and then, coming to the long pastern, will sometimes find small bony excrescences in front and at the side, and their importance will depend upon their relations to the tendons and ligaments thereabout. An ossific growth beneath the tendon of the extensor pedis, or beneath the branches of the suspensory ligament, as they proceed over

the pastern to join it, would be more likely to produce lameness than one occurring in either of the triangular spaces situated between them, and which are covered over by skin alone. Lower down we come to the short pastern, the common seat of ring-bone, which is characterized by a full firm bony growth spread over the front and sides of the bone, and may pass upward over the lower end of the long pastern, or downward to the os pedis or foot-bone, or to both. Its encroachment on important structures, whose action it impedes, renders the formation an unsoundness of the worst form. The fact, however, must not be overlooked, that great differences are found to exist in the natural conformation of the pasterns of different horses, and especially towards the sides, where the tubercles to which the lateral ligaments are attached are sometimes extremely developed, and give the pasterns a prominence and coarseness which it is difficult to differentiate from disease. Any scars and thickenings of the skin and underlying parts about the coronet should be carefully noted. Such conditions may be the remains of a former quittor or carbunculous disease of the coronary band, both of which may return, with the worst consequences.

The Foot.—From this region we descend to the feet, and, comparing the one with the other, remark any difference of size or form, or in the general character of the hoof-horn.

It sometimes happens that one foot is smaller than the other from birth, and where this is known to be so, too much importance must not be attached to it; but it must not be forgotten that such cases are exceedingly rare, and it becomes necessary, without direct knowledge to the contrary, to regard all differences of this kind to have resulted from disease either in the organ itself or in some remote part, necessitating prolonged resting and contraction of the foot as a result.

The fact must not be lost sight of that one or both feet may be considerably reduced in circumference by breakage of the horn or undue paring, and disparity of size may be due to one or other of these causes; here, however, the heels will be open, and in point of width and development correspond with the larger foot. We shall see presently that contraction of the foot resulting from disease is attended with certain well-marked changes which are not difficult to recognize, and which clearly indicate the existence of unsoundness.

The feet may be unduly flat or too deep and upright, as the result of disease, laminitis or fever in the feet being a common cause of the former, and navicular disease, or some more remote affection in which the foot is rested, of the other.

Where laminitis has existed, the hoof usually presents a number of ridges encircling the foot, the hoof-horn is brittle, dry-looking, and coarse

in texture, the heels are low, the toe thick, and in some cases the sole is more or less convex and the front of the hoof concave or sunken. In the morbidly upright deep feet the texture of the horn is close and compact, and the hoof presents a dense solid appearance. This is especially the case in navicular disease, where the sole is very concave, the heel narrow, and the frog wasted. Where these characters exist there can be no doubt as to the animal's unsoundness.

Careful search should at all times be made for cracks in the hoof, or, as they are termed, "sandcracks" (Vol. II, p. 366). These ruptures of the horn occur in various situations, in some of which they are not at once apparent. This is very much the case where they are of limited extent and occupy the upper border of the hoof hidden by the overhanging hair. In the lighter breeds of horses this accident is most frequently seen on the inner quarter, while in draught-horses it is more often noticed in front of the hoof; wherever they occur, they represent a serious form of unsoundness, serious not only on account of the long period required for their treatment, but also because of their liability to recur. The examiner should be on the alert here, for unscrupulous dealers do not hesitate to fill the cracks with composition, and the artful way in which it is done renders deception possible unless the greatest care is observed.

A defect, which in some instances must be included in the category of unsoundness, is that comprehended in the term "shelly feet", by which is understood a dry and brittle condition of the horn, which, being also loose in texture, splits and breaks on the slightest provocation, rendering shoeing difficult, and sooner or later impossible.

Another defect in the horn, to which unsoundness attaches, is that condition of the crust known as "false quarter". Here there is a local deficiency of development in the hoof arising out of an injury to the coronet, in which the horn-secreting band has been to some extent destroyed and the hoof weakened. It is recognized by a deep wide furrow passing from the top to the bottom of the hoof.

Knee (Posterior Aspect).—Turning round, we now direct attention to the posterior aspect of the limb, and the first part requiring notice is the knee. Here we are sometimes confronted with a soft fluctuating swelling on either side, resulting from a distension of the sheath of the tendons with fluid, and commonly termed "thoroughpin" of the knee from its resemblance to that enlargement which appears from time to time above and behind the hock-joint.

The back tendons and ligaments will next come under notice, and as the hand passes over them it should particularly note their condition about the lower part of the upper third of the canon-bone, where the check

ligament joins on to the deep flexor tendon (Vol. II, p. 294). This is the point where sprain most frequently takes place, and where the enlargement which results will be felt when it can be detected nowhere else; but in severe sprain the tendon for a greater or less distance along its course towards the fetlock and the knee becomes enlarged and gives to the leg behind a bowed appearance, hence the term "bowed tendon". A defect of this kind affecting structures of such importance in any part of their course is a serious one, and at once contravenes the animal's soundness. In front of the tendons, and immediately behind the canon-bone, the suspensory ligament (Vol. II, p. 272) will be felt. As we have elsewhere pointed out, this structure divides a little way above the fetlock-joint into an inner and an outer branch, which become inserted into the sesamoid bones behind the fetlock.

Sprain and thickening of this ligament are more especially seen in hunters, chasers, and race-horses. The injury almost invariably occurs either at the point where it divides above the fetlock-joint, or where its branches join the sesamoid bones; but the spread of the inflammatory action from these centres provokes enlargement for varying distances along its course, according to the severity of the sprain.

Each individual branch of the ligament should be examined separately and compared with its fellow, and with those of the opposite limb too, lest a slight uniform thickening of the two should be overlooked. Sprain of this ligament is at all times serious, and must be regarded as an unsoundness.

The Fetlock-joint.—We now come to the fetlock-joint, where one or more of a variety of diseases incidental to it may be found. One or both of the sesamoid bones are sometimes enlarged, and here again they should be compared one with the other and with those of the opposite limb, lest slight but important changes be overlooked.

The joint, as a whole, may be swollen from a general sprain of its structures, or from hard and prolonged wear; but it must be borne in mind that all swellings of this part are not attributable to these causes.

Some, which are commonly spoken of as "filled" legs, are generally the outcome of slight temporary disturbance of the general system, and will disappear when that disturbance ceases to operate. In special cases this defect may result from a weak heart, in which case it would most likely be permanent or periodic, and the cause of it an unsoundness.

Bony growths of one sort or another are not seldom found in the region of the joint involving either the canon or long pastern, or both. Such formations are, for the most part, an unsoundness; but the same cannot be said of all. Brushing or interfering is often accountable for enlargement

of the inner aspect of the joint, and should receive special attention at this stage of the examination. The effect of this mishap may be serious or not, but all horses whose conformation and action predispose to it should be declined.

Distention of the synovial sheaths of tendons which pass over the fetlock-joint behind, or of the capsular membrane of the joint, is commonly observed in smaller or larger bulgings termed "windgalls".

These may be the progressive result of severe work, or arise out of sprain or other injury to the part. In their slighter forms they are unimportant, unless there is evidence of a hereditary predisposition to their formation. This will most likely exist where similar developments are observed in and about other joints, such as thoroughpins, bog spavins, and the like. Where, however, they are large, tense, and resisting, action will be interfered with, and they must, in such circumstances, be regarded essentially as an unsoundness.

The Heels.—As we descend, the heels may afford evidence of the present or past existence of grease. If the former, an offensive discharge will cover the skin; if the latter, the integument will be more or less thickened and thrown into folds, and may be studded over with small hard pimples.

In heavy horses whose legs are covered with hair this disorder may be overlooked, unless a searching examination is pursued.

Cracks and chaps may also exist here and render the horse for the time being unsound.

The Coronet.—Coming to the coronet, the examiner now tests the lateral cartilages with the object of determining if they possess their normal elasticity, or if they have become converted into "side-bones". Pressure should be applied to them from behind forward along their entire length, first while the foot is on the ground, and again after being lifted up and the weight removed from it.

Some horses' cartilages are naturally thick and resisting, while others are thin and yield to very slight pressure. In old horses they become hard with age without necessarily being ossified, and such cases call for considerable experience and judgment. Where, however, the existence of side-bone is established, unsoundness follows.

Damage to the heel as the result of overreach may lay the foundation for unsoundness, and scars arising out of this cause call for some attention.

The Sole and Frog.—It becomes necessary now to examine further the foot, more especially as to its ground surface. Having observed the width of the heels, the examiner lifts it up, and so brings the sole and frog under observation. In a normal condition the former should describe a

gentle arch upward. Any extreme concavity must receive careful consideration. It may be due to an overgrowth of the crust being permitted in the course of shoeing, but it is frequently the result of contraction of the wall consequent upon some deep-seated trouble, such as navicular disease.

Confirmation of this will be found in a shrunken frog, a thick, solid, upright, blocky-looking hoof, and more or less obvious lameness. Some degree of hollowness or undue concavity of the sole will arise from many causes which have led to the foot being rested for a long period, and which of course must be associated with unsoundness. It must, however, be pointed out that where, as a consequence of indifferent shoeing, the crust is permitted to remain too deep or to project too far beyond the sole, the latter will have the appearance of being too concave, and may be actually so. Whether it is or not is a matter for the examiner to decide from the general appearance of the organ.

The frog will claim attention now. It should be free from thrush and canker. A good, wide, deep, bold frog is much to be desired. A small, dry, shrunken frog is an object of some suspicion, especially in aged horses, where it may be associated with navicular disease, or some ailment for which the foot has been rested. Although not an unsoundness in itself, it is an indication significant of disease elsewhere, and calls for careful consideration. Thrush in its milder form, when unattended with lameness, does not constitute unsoundness, but where the sensitive frog is much exposed it must be so considered.

In those cases where the frog is broken and ragged the detached portions should be removed, and the general surface of the organ inspected for underlying disease.

Canker which appears in the form of a fungating growth about the frog or sole, or both, attended with an offensive discharge, is one of the worst forms of unsoundness.

The sole may be too flat, but, as a natural conformation, will not come under the category of unsoundness unless identified with lameness; it is nevertheless a sign of weakness, and horses with flat soles are never a desirable purchase.

When the sole has become convex, or, as it is frequently expressed, "dropped", as the result of laminitis or any other cause, the animal is unsound.

The Stifle.—From the fore-limbs we pass to the hind ones, and here, in addition to many of the diseases already noticed, there are others peculiar to them requiring special consideration.

The stifle should be free from enlargement or from any hereditary or acquired impediment to its perfect action.

With reference to the former an increase of size is sometimes found to result from an overfulness of the joint capsule with synovia, which presents itself as a fluctuating swelling, or a more firm swelling may exist in one or another part of the joint or over its general circumference, as a consequence of a past injury, or there may be sudden displacement, luxation, or "slipping out" of the patella or knee-cap, followed or not by an equally sudden return to its natural position. Some animals inherit a form of development of the stifle which permits this dislocation and return of the bone at uncertain periods. It is possible, therefore, that, however careful an examination may be conducted, this serious defect may not be detected. In some cases it is brought on by weakness, following upon influenza and other debilitating ailments, and may not show itself while the animal is under inspection. From whatever cause it may arise it impairs the usefulness of the animal and renders him unsound.

The Hock.—Passing from the stifle to the hock, we have here to notice in the first place the "point", which should be free from every form of swelling. Sometimes, as a result of injury, enlargement of this part is found to exist. The enlargement will vary in its character in different cases, and also in its relation to legal soundness. A capped hock, as it is termed, may consist of nothing more than a little fluid infiltrating the loose tissue beneath the skin, and causing no present or prospective interference with the horse's action or power to work, in which case its presence is not inconsistent with a state of soundness; but it would be otherwise if the swelling were inflamed and painful, and caused the animal inconvenience, or if it involved the synovial sac which intervenes between the tendon and the point of the bone, as the one plays over the other.

From the point of the hock downwards to the fetlock-joint the posterior border of the leg should descend in a straight line. It sometimes, however, happens that this rule is departed from even in the absence of disease.

When the head of the outer splint-bone is more than usually developed, as sometimes occurs, a bulging is formed behind the hock which gives the appearance of a curb, and has on many occasions been mistaken for one. The bulging caused by a true curb stretches across the back of the leg, while the projection formed by the bone is confined to the outer side, where the bone is situated. Moreover, when the fingers are passed over a curb, it is found to yield somewhat to pressure, whereas the bone is hard and resisting.

Curbs vary very considerably in size. Some are observable and distinguishable at once, but others are small and only just raise the line of the leg.

Although horses having curbs must be regarded as unsound, it must

not be lost sight of that many animals so affected do life-long work without further mishap, and we should therefore say that, where the curb is small and unattended with lameness, the legs well formed, and the horse in hard condition, but little risk would attend the purchase of such an animal if the work required of him was not severe.

Many good horses, because of curb, have been rejected by intending purchasers in favour of an indifferent brute having some sort of title to be called "perfectly sound".

In front of the point of the hock and behind the leg-bone is the tendon of the deep flexor muscle, whose sheath sometimes becomes largely distended with synovia, forming a fluctuating tumour passing from one side of the hock to the other, and commonly termed thoroughpin. Young horses are most frequently its subjects, and especially those of the heavy breeds while being got up for show. Although an unsoundness for the time being, it should not be forgotten that they frequently disperse altogether without showing any disposition to return.

A similar condition may also be found to exist in the true hock-joint, the capsule of which is made to bulge at the upper and inner part by synovial distension, causing what is termed a "bog spavin" (Vol. II, p. 290). Here again we have a state of unsoundness which, when occurring in young animals, frequently disperses and may not recur.

Having decided as to the presence or absence of bog spavin, the examiner then passes the hand over the inner face of the joint, taking note of any abnormal condition or swelling at the lower part, which is the seat of bone spavin (Vol. II, p. 217). As to whether such a disease exists or not is frequently a difficult and sometimes an impossible question to answer correctly, even by the most accomplished expert.

The conformation of the hock varies to a considerable extent in different animals of the same variety, and in many instances in the two hocks of the same animal, when the hocks are said to be "odd".

In some they present a relatively flattened surface, the natural bony prominences being slight, and the general outline of the joint is regular and refined, while others are conspicuous by their coarseness, in which the natural prominences of the bone are greatly exaggerated, and stand out from the surface in bold projections. Such hocks are known as "coarse hocks", but in numerous instances, where the coarseness has been specially marked over the seat of spavin, it has been mistaken for that disease. To distinguish between the normal and the abnormal condition in these cases needs not only a large experience of hocks at all periods of life, but a clear comprehension of the anatomy of the part.

Coarseness of the hocks is generally associated with the same condition

in the other joints of the extremities, and these will sometimes help in a solution of the difficulty.

It remains, however, that bone spavin, as an objective symptom, is an abnormal growth of bone on the inner and inferior part of the joint, but with this there is usually associated more or less disease of a destructive nature going on between the bones, by which their articular surfaces become disorganized. It follows from this that the malady is attended with lameness, in which the hock-joint is but imperfectly flexed, the step is short, and the weight of the body quickly displaced from the affected limb. When this disease is suspected, some confirmation may be found in the fact that the affected animal leaves the stable with a halting gait after rest, which becomes much less pronounced or altogether disappears as he continues a journey.

The disease we have already referred to as existing between the bones of the hock may be present without any perceptible enlargement on the surface, but all the other symptoms described will be present. This condition is termed "occult spavin" from the fact that there is no visible enlargement to account for the lameness which, judged by the action, is due to hock mischief.

Whether the disease be occult or visible, spavin, it is hardly necessary to say, constitutes an unsoundness of the worst form.

EXAMINATION OF THE WIND

Having so far disposed of the organs of locomotion, the examiner must now direct his attention to the state of the breathing apparatus, for which purpose the horse must be subjected to exertion.

In carrying out this task the place selected should be as quiet as possible, and the attention of the examiner should be fixed upon the sounds given out during respiration. The position he takes up should be to windward, so that the sound emitted may be conveyed towards him. Wherever the examination is being conducted he should take up a position alone, and not allow his attention to be diverted from its purpose by any conversation with others. Noisy dogs in dealers' yards, the shouting of men, and cracking of whips are not calculated to render this part of the examination as satisfactory as it should be.

The horse, having been mounted, should be made to trot sharply in a circle for a few minutes, and then brought to the canter and finally to a sharp gallop.

In drawing a conclusion upon this test regard must be paid to the fact that the breathing sounds emitted by different horses are liable to some

variation within the limits of health, according among other things to condition, formation of the face, setting on of the head, temperament, &c. Space will not allow us to examine these several questions here. Suffice it to say that any noise which partakes of the nature of roaring or whistling is an indication of unsoundness, and denotes the existence of some obstructive disease in the respiratory passage leading to the lungs. In a very large majority of cases the defect is located in the larynx, the entrance to which becomes narrowed in consequence of paralysis of the small muscles, whose duty it is to keep the passage open.

Thickening of the mucous membrane of the larynx from cold, influenza, and strangles, enlargement of neighbouring glands, and tumours about the throat may each and all, by their pressure and narrowing influence, be the means of causing roaring.

Tumours and bony excrescences in the nostrils may also give rise to the nasal form of this unsoundness.

"Punching" is a test commonly resorted to by dealers, and consists in striking the animal suddenly over the body with a stick or the closed fist, followed up with a succession of feints to repeat it while the animal is firmly held against a wall. The test is not a reliable one, although in the majority of roarers it causes the emission of a deep, sonorous grunt. It is, however, useful in the sale-yard, where no opportunity is afforded of resorting to other means.

REMOVAL OF THE SHOES

The examination will be concluded by having the shoes removed, when the ground-surface of the crust will be exposed, and with it any shelliness or seedy state of the hoof. The latter consists of a cavity extending for some distance up the crust, and unscrupulous dealers sometimes resort to the practice of filling it in with some preparation of pitch and other matters. Care should be taken, therefore, to expose any such deception that may exist.

THE TEETH OF THE HORSE

Section X.—THE TEETH OF THE HORSE

NUMBER AND ARRANGEMENT

In reference to their structure and arrangement, also as a means of ascertaining the animal's age, more accurately at least than by any other method, the teeth of the horse are peculiarly interesting.

In the chapter on the horse of the present day and its fossil progenitors, referring to the peculiar features in the conformation of the horse, the special characters of the teeth will be described, and their relation to the same organs in the earlier types of horse-like animal commented on.

For the present purpose it will only be required that the characters of the different descriptions of teeth, and the changes which they undergo in consequence of the wear to which they are subjected, should be noted sufficiently to enable the horseman to form some opinion as to the animal's age.

Number of Teeth.—When the dentition is completed at the age of five years, the horse has six incisors or nippers in the front of the mouth, in the top and bottom jaws, and six molars on each side, top and bottom jaws. The three last of the row are true molars, the three in front of them are distinguished as pre-molars. In addition, in front of the anterior pre-molars on each side of the top jaw there is often seen a small conical tooth, which, notwithstanding its insignificant appearance, is in the popular view an organ of some importance. The term eye-teeth is generally applied to these rudimentary organs, and it is believed, even by people who ought to know better, that the presence of this tooth in some extraordinary way is a cause of blindness, and in the case of a horse of three or four or five years of age having any disease in the eyes, it is usual to look in the animal's mouth in order to see if the eye-teeth, or, as they are sometimes called, "wolves' teeth", are present. If so, they are immediately removed by a somewhat primitive method of punching. An ordinary punch, which is used for the preparation of nail holes for the horse's shoes, and the shoeing hammer are found to be effective instruments for the

operation. As these rudimentary organs have a very slight hold in the jaw, a very moderate amount of force will dislodge them, and the horse is neither better nor worse for the performance.

Reference to the section on the conformation of the horse will convince the reader that the small conical tooth, to which so much importance is attached, is really the vestigial remains of the first pre-molar, which is a well-developed tooth in the top and bottom of both sides of the mouth in many of the ancient ungulate mammals, making a row of seven instead of six molars, of which four were pre-molars and three true molars. The gradual diminution in size of the first pre-molar may be traced in the fossil remains of horse-like animals of the tertiary formation. In the horse of the present time the first pre-molar has altogether ceased to exist in the bottom jaw, and only remains in the top jaw as a rudimentary and occasional structure, which is frequently shed when the temporary pre-molars are exchanged for permanent. A peculiarity in the horse's mouth more difficult to account for than that above referred to is the space which exists between the molar teeth and the incisors. This space did not exist in the most ancient mammals, but in the Phenacodus there were some indications of it, and it becomes more distinct through the series of horse-like animals which will be described in the chapter on the peculiar features of the conformation of the horse. In the male of the horse family the space is partly occupied by the canine teeth or tusks; in the mare these organs are either entirely absent or are merely rudimentary.

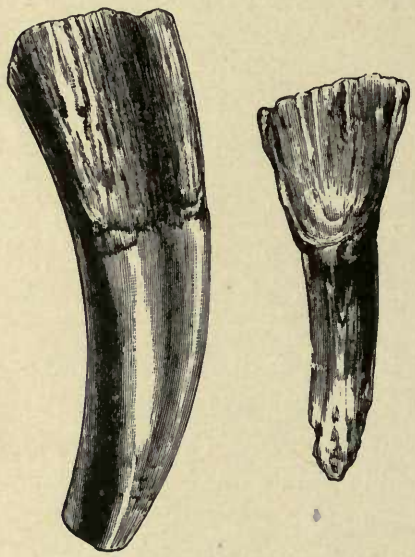


Fig. 600.—Permanent and Temporary Incisors of Horse

Form and Arrangement.—Some knowledge of the form and general arrangement of the different orders of teeth are essential for an intelligent appreciation of the changes which take place owing to wear in one direction, and the growth of the organs in the other.

The incisor teeth are chiefly used as a means of judging the age after permanent dentition is complete. Up to that time the change from temporary to permanent organs, both incisors and molars, affords important indications of the age of the animal from birth up to the age of five years.

For the purpose of distinguishing the temporary from the permanent organs, an illustration will be more useful than a written description, and

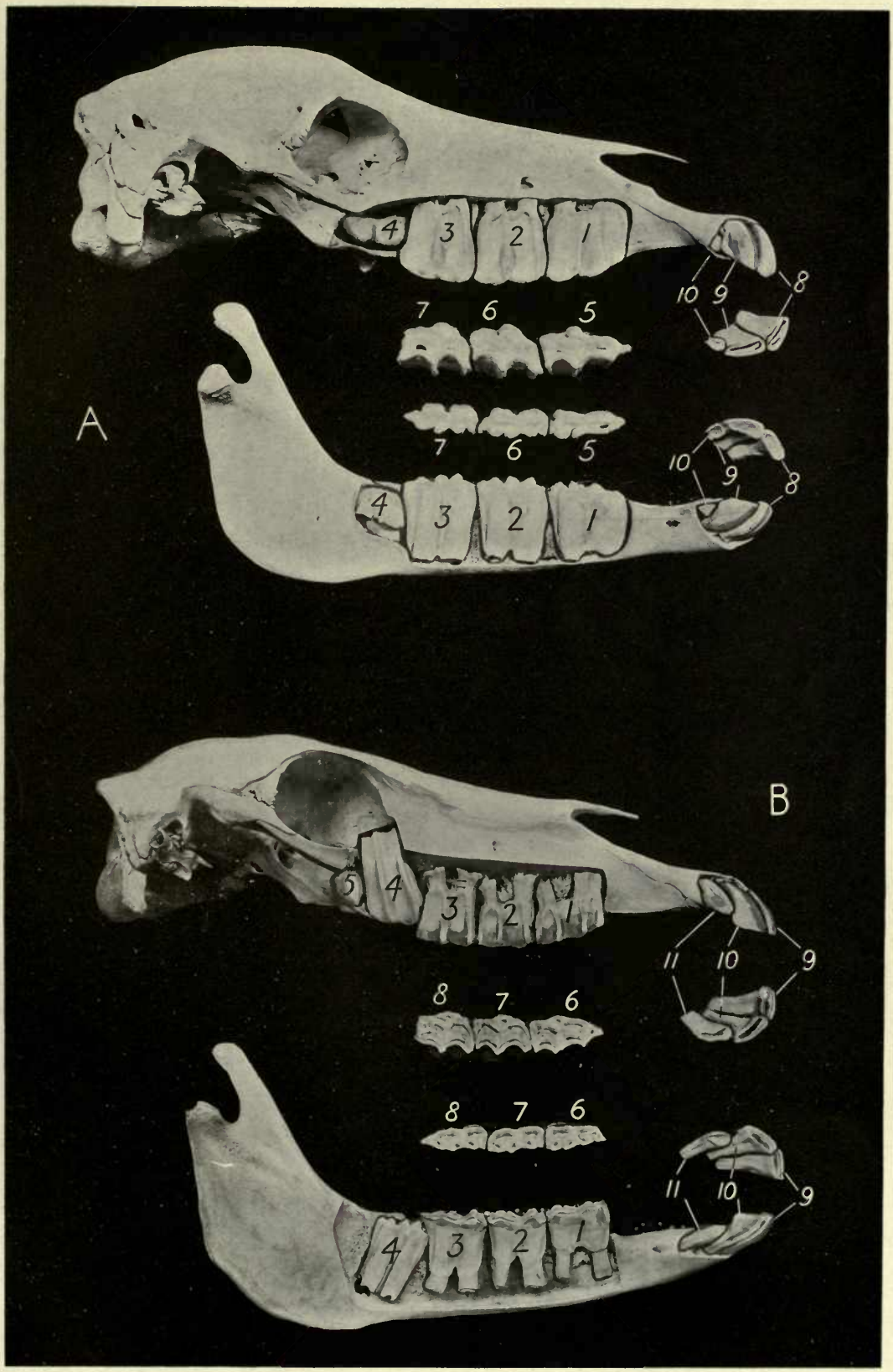
DENTITION OF THE HORSE AT VARIOUS AGES—I

A. Thoroughbred at birth (male).

1, 2, 3. Temporary molars.
4. Permanent molars (uncut).
5, 6, 7. Crowns of temporary molars.
8, 9, 10. Central, lateral, and corner temporary incisors.

B. Four-month-old New Forest Pony (male).

1, 2, 3. Temporary molars.
4. Permanent molars.
5. Permanent molar (uncut).
6, 7, 8. Crowns of temporary molars.
9, 10, 11. Central, lateral, and corner temporary incisors.



DENTITION OF THE HORSE AT VARIOUS AGES—I

A. Thoroughbred (male) at birth. B. Four-month-old New Forest Pony (male).

in fig. 600 the temporary and permanent incisors of the horse are shown side by side.

No difficulty could possibly be experienced when the two organs are removed from the jaw for the purpose of examination—the difference in form and size is quite apparent; but it may also be noticed that the permanent incisor decreases in width from above downwards, without showing any line of separation between the upper part of the tooth which is called the crown, and the lower part, or fang. In the temporary incisor the distinctive boundary between the two parts is perfectly well defined. These differences are not quite so well marked when the teeth are looked at in the mouth of the living animal, but the small size of the crown, and the absence of deep grooves in the temporary incisors, will be sufficient to enable the observer to distinguish the one from the other during the period of change from temporary to permanent teeth. It is not, however, quite so easy to distinguish the temporary from the permanent incisors in ponies between one and two years of age, as these animals very frequently present some of the adult character in their general conformation; and when the judgment is to be formed entirely by an examination of the teeth, it is quite possible for one who is not an expert to mistake a well-developed pony of one year old for a five-year-old, and one of two years old for a six-year-old.

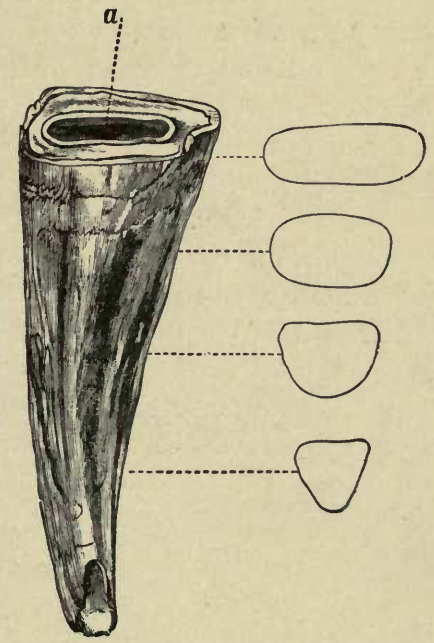


Fig. 601.—Permanent Incisor, showing sections at various points. *a*, The central cavity.

The difficulty, however, may be at once disposed of by an examination of the molar teeth.

To appreciate the variations which take place in the outline of the worn surfaces or tables of the incisor teeth as age advances, it is desirable that the examiner should have a clear understanding of the peculiarities of form in these organs, which render a certain fixed series of changes in the outline of the tables quite inevitable. In the next figure (fig. 601), representing a permanent incisor of a horse, it will be seen at once that the long diameter of the table is exactly at right angles with the long diameter at the base of the tooth. Further, it will be seen in the drawing, which shows the tooth as seen from the back, that a ridge extends from

near the upper surface to the bottom of the tooth, causing the opening at the base of the fang to represent a triangular figure. Consequently, sections commencing at the upper part of the tooth, and carried down to the bottom of it, would represent the forms which are shown on the right-hand side of the drawing. The wearing of the teeth from the upper surface downwards is compensated by the growth of the tooth upwards from its cavity, and the changes in the form of the table as the animal advances in life are necessarily a gradual approach to the triangular form.

Besides the changes in the form of the table which the tooth undergoes during the course of its natural wear from constant attrition, there are also changes relating to the "mark", which is the name in common use to indicate the cavity in the centre of the tooth, which becomes dark or black in colour from the action of the food on the bony structure. The cavity is formed by the inversion of the three structures of the tooth, the crusta, enamel, and ivory.

The hollow cone extends about half-way down the incisor tooth, and consequently, when the wear reaches to a certain point, the cavity is obliterated, or, in the horseman's language, the mark is worn out.

One result of the inversion of the tooth structures to form a hollow cone in the interior of the incisor is a peculiar arrangement of lines on the worn surface. This condition is shown in fig. 601. An outer line of white enamel is seen, inside which is the broader line formed by the bulk of the tooth—the ivory; then the inner line of enamel which belongs to the inverted cone, with the lining of crusta, which is originally on the outside of the tooth, but in the inverted structure is necessarily on the inside. This structure is quickly darkened by contact with food. The darkening is also distinctly seen on the crusta on the outside of the tooth, being especially marked in the grooves. The prominent parts of the surface become white in consequence of the darkened crusta being rubbed off by the movement of the animal's lips. It will be obvious that the table of the tooth exhibits the following features:—

1. An outer ring of enamel. The outer covering of crusta is at the edge of the tooth worn away.

2. A broad line of ivory, in the centre of which is a faint line, showing the junction of the inverted cone with the outer shell of the tooth.

3. A ring of enamel called central enamel, with the line of dark crusta inside it.

It is necessary to note here that the changes in form of the central enamel afford important evidence of the age after seven years.

Tricks.—Horses at the middle period of life are more valuable than when very young or very old. It is not remarkable, therefore, that certain

devices are adopted for the purpose of, in the first place, facilitating the cutting of the permanent teeth to make young horses look older than they are, and, on the other hand, to restore the "mark" when it is obliterated, for the purpose of making old horses look younger.

The extraction of the temporary teeth will undoubtedly assist the development of the permanent organs beneath them, and if the operation is properly done the deception would not be detected; but as a professional operator would not be likely to be consulted in the matter, it is usually badly done, and defeats its object, either by destroying the germ of the new tooth below and leaving an obvious gap in the mouth, or by causing it to be displaced, and in that way leading to a derangement of the dental line. The second form of deception, termed "bishoping", is probably rarely or never practised now. It consists in carving a properly-shaped cavity in the extremely hard bone of an old tooth and making it black by heat, a performance which would require great mechanical skill and most perfect apparatus, and, however well performed, certainly would not deceive anyone who had the slightest claim to be an anatomist or a judge of a horse.

Birthdays.—It is usual to preface a description of the means of judging the age of the horse with the statement of dates, which are somewhat arbitrarily fixed as birthdays, and also to interpret certain qualifying terms which are constantly employed.

The ages of thoroughbred horses are dated from January 1st, and of other horses from May 1st. The animal which is approaching the termination of any given year is said to be "coming" the age; if the birthday has passed, he is said to be "off". Thus "coming four" is taken to mean that the horse wants about three months of the full age, and "four off" would indicate that his fourth birthday had passed about three months previously. The expert, however, will judge of a horse's age by the state of his teeth, without concerning himself about the dates which have been artificially fixed, and are indeed to a certain extent convenient.

TEMPORARY DENTITION

It is not a matter of much importance to be able to judge the age of a foal during the first few months, nor of a colt during the first year or two of its life, but in order to make the history of the evidence which the teeth afford complete, it is necessary to begin with the animal's birth. The first teeth, it is understood, are known as milk teeth, and at the time of birth the foal has four incisors in top and bottom jaws, and three molars on each side of the upper and lower jaws. All these teeth are entirely, or nearly

covered with the gum, but they are seen quite distinctly in outline, and here and there the points may appear uncovered. The condition of the temporary incisors is indicated in the illustration (fig. 602).

It will be observed that the front or central incisors are much larger than the next in order—the lateral incisors. The drawing represents the

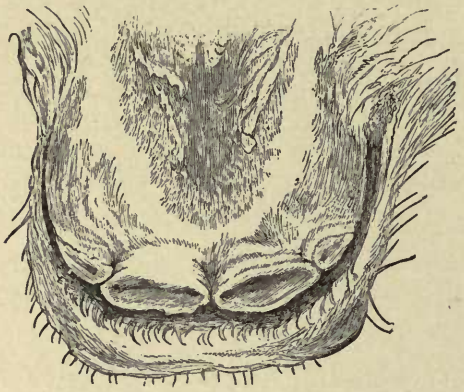


Fig. 602.—Incisors of Colt at birth

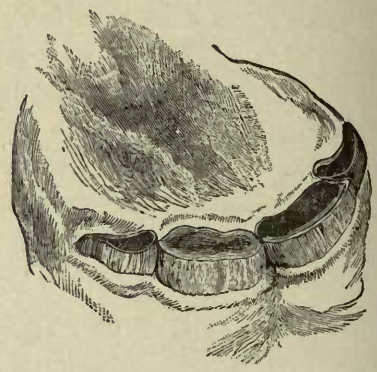


Fig. 603.—Incisors of Colt at two months

bottom jaw, which is usually examined; but the condition of the teeth is very much the same in both jaws.

For six or seven months after birth no additions are made to the number of molars or incisors. The four incisor teeth, top and bottom, gradually advance and the gum recedes, and at the

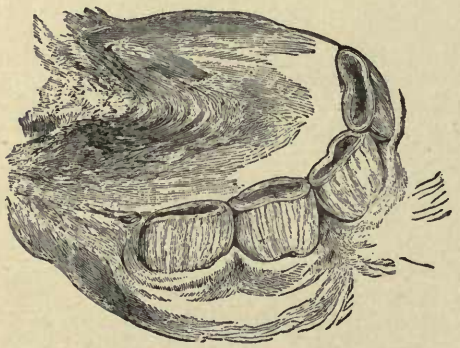


Fig. 604.—Incisors of Colt at six months

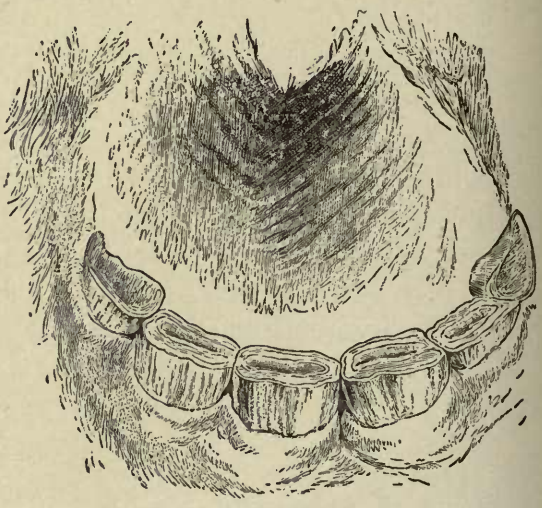


Fig. 605.—Incisors of Colt at one year

age of six months the appearance of the front of the mouth is as shown in the drawing (fig. 604).

The incisors show a line of wear on their upper surfaces, and the molars also exhibit a worn surface.

At nine months preparations are being made for the teeth which

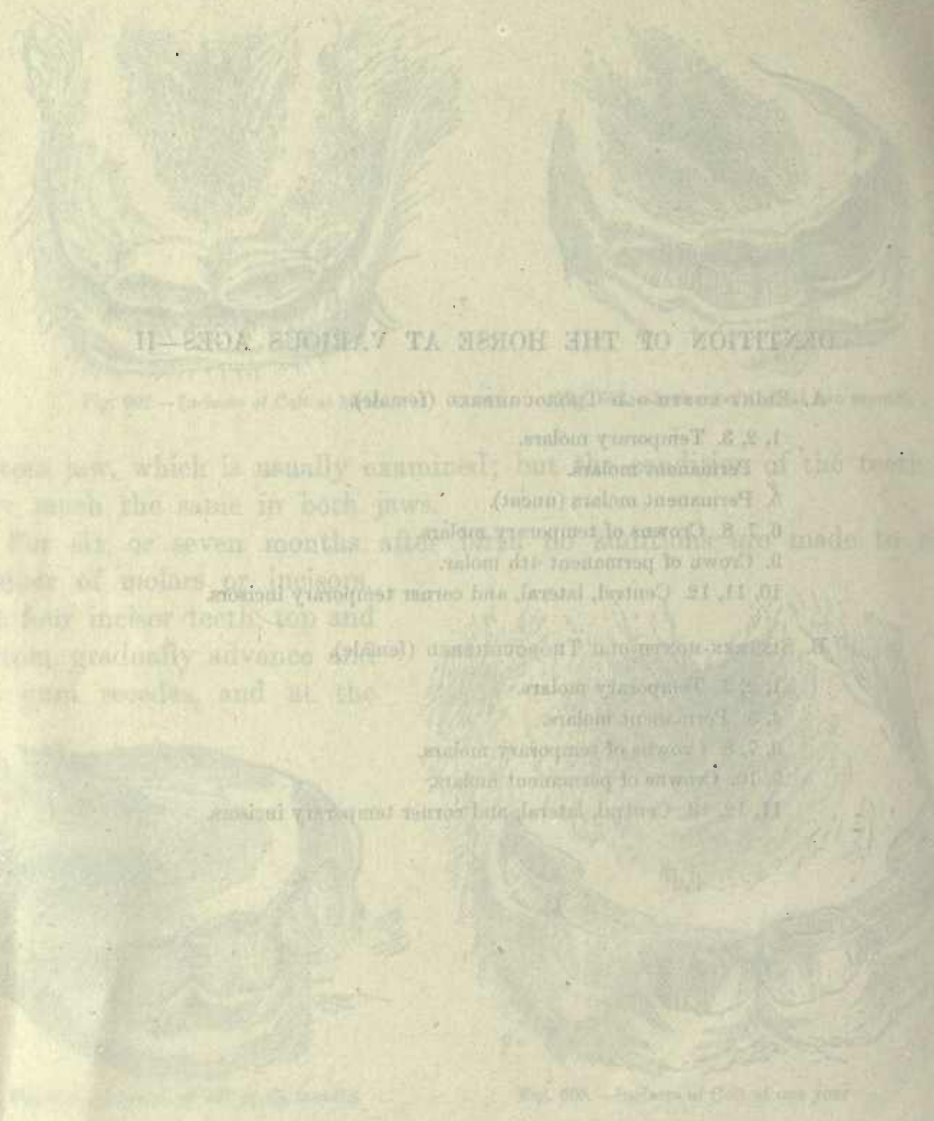
DENTITION OF THE HORSE AT VARIOUS AGES—II

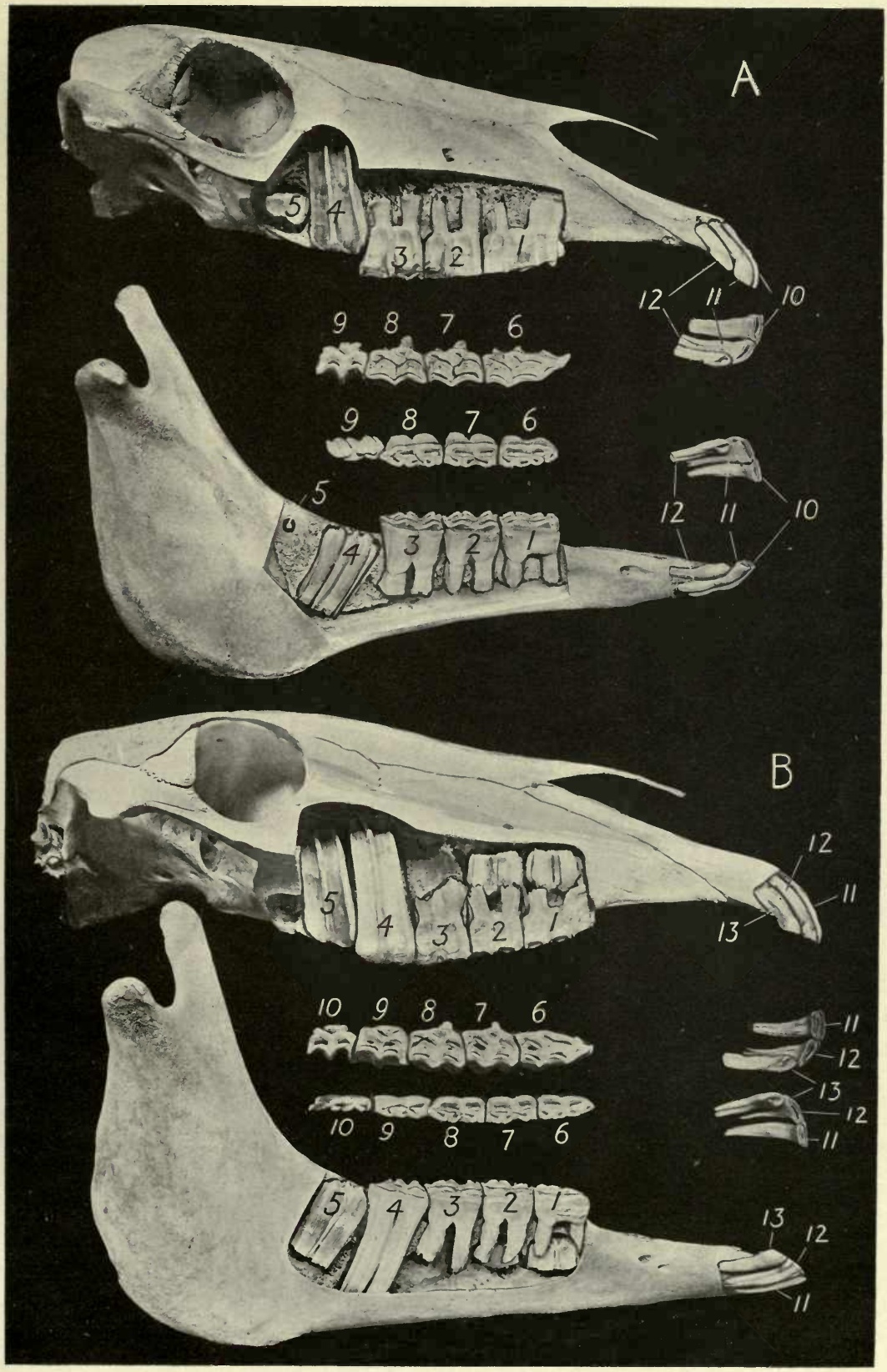
A. Eight-month-old Thoroughbred (female).

1, 2, 3. Temporary molars.
4. Permanent molars.
5. Permanent molars (uncut).
6, 7, 8. Crowns of temporary molars.
9. Crown of permanent 4th molar.
10, 11, 12. Central, lateral, and corner temporary incisors.

B. Sixteen-month-old Thoroughbred (female).

1, 2, 3. Temporary molars.
4, 5. Permanent molars.
6, 7, 8. Crowns of temporary molars.
9, 10. Crowns of permanent molars.
11, 12, 13. Central, lateral, and corner temporary incisors.





DENTITION OF THE HORSE AT VARIOUS AGES—II

A. Eight-month-old Thoroughbred (female). B. Sixteen-month-old Thoroughbred (female).

indicate the age of one year. The corner incisors, completing the number of six, begin to protrude through the gum, as does also the fourth molar behind the three pre-molars, and at the age of one year the front and back of the mouth will present the appearance of the drawings (figs. 605, 606).

So far as the appearance of the incisor teeth is concerned, it will be noticed that it closely coincides with that of the mouth of the horse at five

Fig. 606.—Molar Teeth of Colt at one year

years old (fig. 613). The prominent difference, however, is that all the teeth are temporary in the one case and permanent in the other. The presence of the tusks, or in their absence the existence of six permanent molars, in the five-year-old horse, will prevent any mistake being made as to the animal's age. It has already been stated that in the case of forest ponies an error in regard to the animal's age is quite possible unless the difference between temporary and permanent teeth is recognized.

Fig. 607.—Molars of Colt at two years

Between one year and two years of age the only change in the incisor teeth is that which is naturally consequent on growth of the teeth and the wear of the upper surfaces by attrition. At the full age of two years the upper surfaces of all the incisor teeth are worn flat, and the tables, which is the name given to the worn surface, are fully formed, which means that there is a complete line of wear running round the central cavity (infundibulum or mark). Occasionally there is an exception in the posterior or inner edge of the corner tooth, the wear of which is not quite complete.

In the two following figures the appearance of the incisors and molars at two years old is shown (figs. 607, 608).

Any question which may arise as to the distinction between one and two years is settled at once by reference to the molar teeth. Shortly before two years of age a fifth permanent molar begins to prick through the gum, and at the completion of the second year the eruption is nearly perfect, as shown in fig. 607.

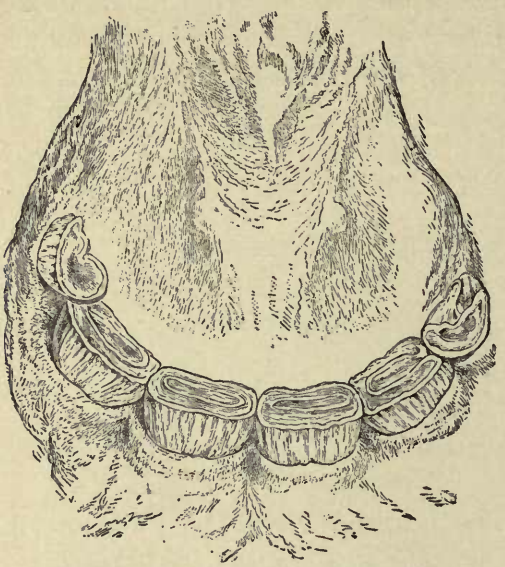


Fig. 608.—Incisors of Cart Filly at two years

The colt has now a full set of temporary incisors in front of the mouth, top and bottom, all of them showing a year's wear on the surface, with three pre-molars (temporary) on each side, top and bottom, and two true molars (permanent) on each side, top and bottom.

Changes which occur in the teeth up to the age of five years will include the falling of the temporary organs and their replacement by permanent teeth, the cutting of the tusks in the horse, and the eruption of two molars—the third and sixth in situation.

ERUPTION OF THE PERMANENT TEETH

When it is stated that between two and five years the change from temporary to permanent teeth is effected in regard to twenty-four temporary teeth, it will be apparent that the process is conducted with considerable rapidity; in fact, a large instalment of the total takes place during the third year of the animal's life, in which period four incisors and eight molar teeth are changed for permanent teeth.

Soon after two years the red and depressed condition of the gum round the upper central temporary incisors indicates that the teeth are being pushed out of their place by the permanents growing underneath them. These signs are quickly followed by similar signs in the lower temporary incisors, and by two years and a half the four permanent organs are usually cut, and the mouth presents a very peculiar and characteristic appearance. At three years old the four incisors are usually fully developed, as shown

DENTITION OF THE HORSE AT VARIOUS AGES—III

A. Two-year-old Hackney (female).

1, 2, 3. Temporary molars.
4, 5. Permanent molars.
6. Permanent molar (uncut).
7, 8, 9. Crowns of temporary molars.
10, 11. Crowns of 4th and 5th permanent molars.
12, 13, 14. Central, lateral, and corner temporary incisors.

B. Three-year-old Cart Horse (male).

Upper Jaw

1. Permanent molar.
2, 3. Temporary molars.
4, 5, 6. Permanent molars.
7. Crown of 1st permanent molar.
8, 9. Crowns of 2nd and 3rd temporary molars.
10, 11, 12. Crowns of 4th, 5th, and 6th permanent molars.
13. Central permanent incisor.
14, 15. Lateral and corner temporary incisors.
16. Tusk.

Lower Jaw

1, 2. 1st and 2nd permanent molars.
3. 3rd temporary molar.
4, 5, 6. Permanent molars.
7, 8. Crowns of two first permanent molars.
9. Crown of 3rd temporary molar.
10, 11, 12. Crowns of 4th, 5th, and 6th permanent molars.
13. Central permanent incisor.
14, 15. Lateral and corner temporary incisors.
16. Tusk.

In the two following figures the appearance of the incisors [illegible] at two years old is shown (figs. 607, 608).

Any question which may arise as to the distinction between [illegible] two years is settled at [illegible] by reference to the molar [illegible] before two years of age [illegible] permanent molar begins to [illegible] through the gum, and at the [illegible] [illegible] the [illegible] [illegible] shown [illegible] a full [illegible] in front [illegible] bottom, all [illegible] [illegible] the surface, with three [illegible] [illegible] top and [illegible] and two true molars (permanent) on each side, top and bottom.

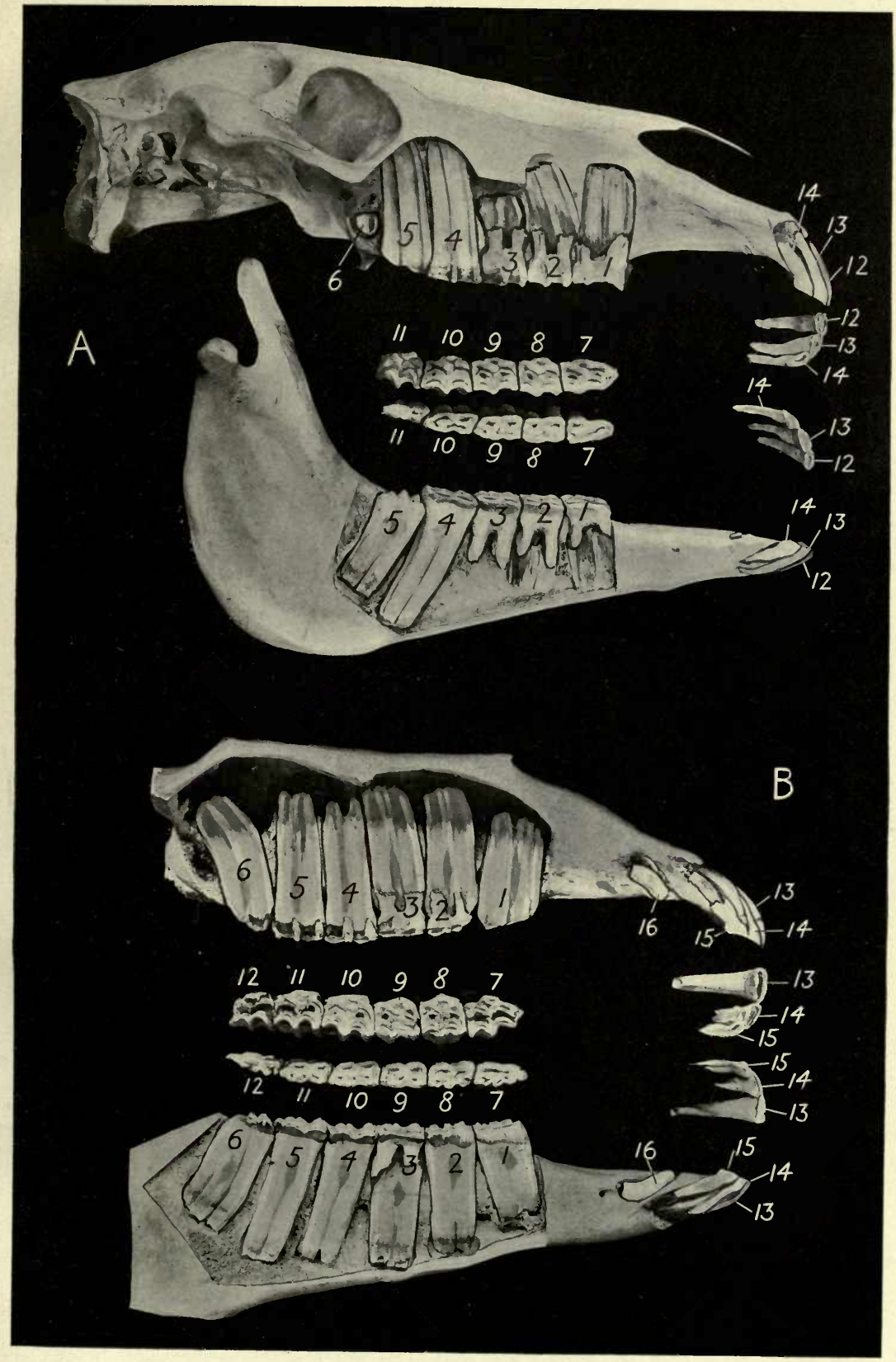
Fig. 608.—Incisors of Cart Filly at two years.

Changes which occur in the teeth [illegible] two years will include the falling of the [illegible] replacement by permanent teeth, [illegible] and the eruption of two molars—the third and sixth in situation.

ERUPTION OF THE PERMANENT TEETH

When it is stated that between two [illegible] temporary to permanent teeth is effected [illegible] temporary teeth, it will be [illegible] considerable rapidity; in fact, a large instalment of [illegible] the third year of the animal's life, in which period four incisors and [illegible] molar teeth are changed for permanent teeth.

Soon after two years the red and depressed condition of the gum round the upper central temporary incisors indicates that the teeth are being pushed out of their place by the permanents growing underneath them. These signs are quickly followed by similar signs in the lower temporary incisors and by two years and a half the four permanent organs are usually cut and the mouth presents a very peculiar and characteristic appearance. At three years old the four incisors are usually fully developed, as shown



DENTITION OF THE HORSE AT VARIOUS AGES—III

A. Two-year-old Hackney (female). B. Three-year-old Cart Horse (male).

by the wear of the anterior edge, which is well marked in the drawing below (fig. 609).

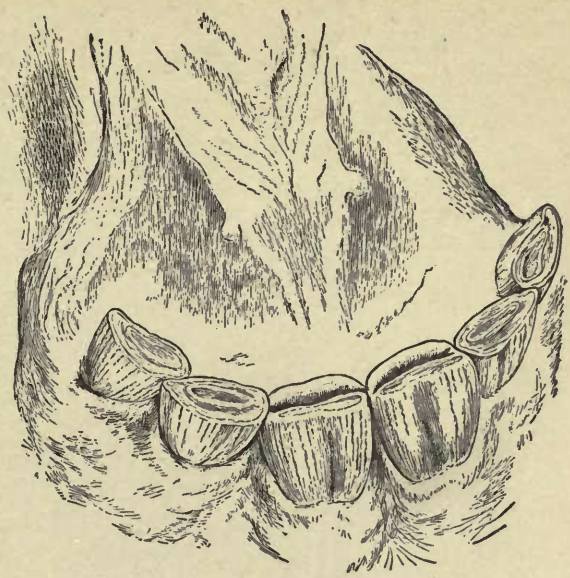


Fig. 609.—Incisors of Horse at three years

Meanwhile the first and second pre-molars (temporary) have been passing through the same changes as those which have been described in the four central temporary incisors, and at the age of three years there are eight new molar teeth, two on each side in both jaws, top and bottom. These recently-cut permanent pre-molars are distinguished by their surfaces being comparatively free from wear, while the molars behind them are worn quite flat.

Fig. 610.—Molars of Horse at two years and seven months

The illustration (fig. 610) shows the state of the molars at two years and seven months.

The next changes affect the lateral temporary incisors, top and bottom,

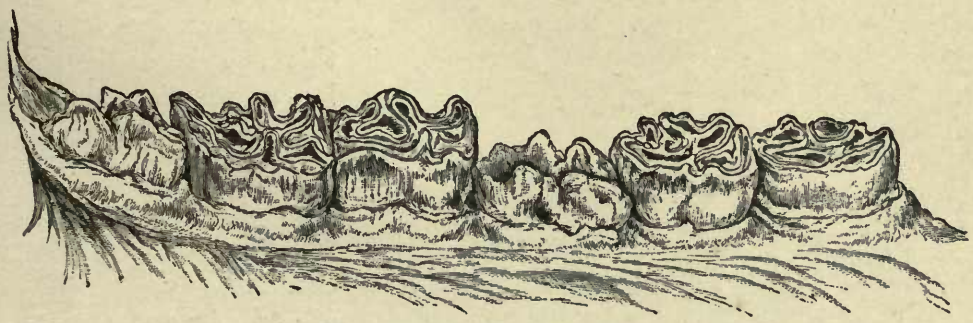


Fig. 611.—Molars of Horse at three years and eight months

and the third pre-molar (temporary), and include the eruption of a sixth molar at the back of the mouth, which is cut at the same time as the third

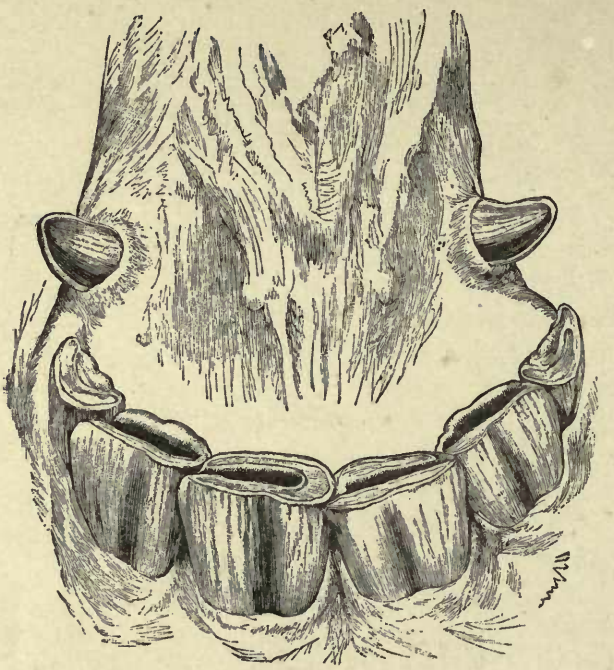


Fig. 612.—Incisors of Horse at four years

Fig. 613.—Incisors of Horse at five years

pre-molar. The tusks in the horse are also frequently cut at four years, although they are not well developed until five. The next two illustrations show the condition of the molar teeth at three years and eight months (fig. 611), and the state of the incisors at four years (fig. 612).

Thus, during the fourth year of its life, the horse has sixteen permanent teeth advancing, and the eruption is often completed by the end of the year. In short, the permanent dentition is completed, excepting the corner teeth, which are changed for permanent during the following year; at five years old, therefore, the condition of the front of the mouth will correspond to the next drawing (fig. 613).

The corner tooth at this age is distinguished by a peculiar shell-like appearance. The posterior edge is considerably lower than the anterior edge, which is the only part of the tooth on which the effects of wear are apparent. The tables of the central and lateral incisors are fully formed, the cen-

tral cavity being surrounded by a continuous line of worn surface. In the central incisors the central cavity is extremely shallow.

With the changes above described, the evidence afforded during permanent dentition is completed.

CHANGES IN THE FORM OF THE TEETH FROM WEAR

It is customary in examining the mouth of the horse, after the animal has reached the age of five years, to devote special and sometimes exclusive attention to the state of the corner incisors. In cases, however, where an exact opinion is important, the state of the other incisor teeth deserves consideration.

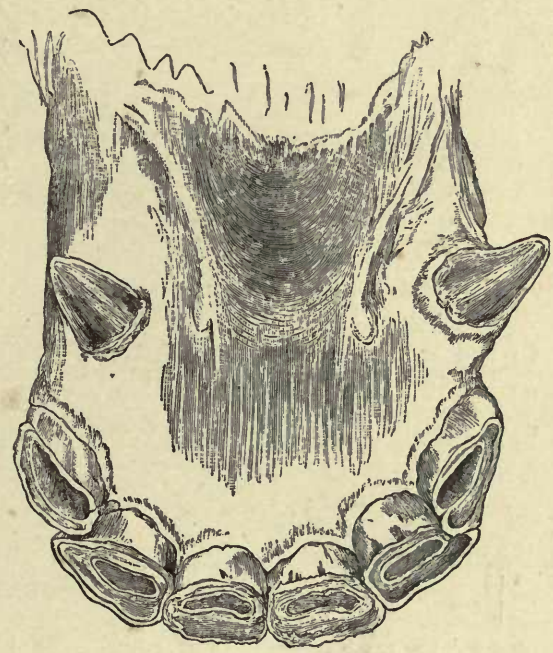


Fig. 614.—Incisors of Horse at six years

Between five and six years the anterior edge of the corner tooth necessarily undergoes wear, which finally extends along the whole front of the tooth, so that at the completion of the sixth year the incisor has lost its shell-like character; the posterior edge, however, still retains its rounded appearance. These characters are shown in the next illustration (fig. 614).

At seven years of age the whole of the incisor teeth have assumed a more solid character, and it will be seen at once that they are in some degree approaching the triangular form which is the result of the combined effects of the wear taking place at the upper part, while the teeth are constantly growing from below.

The central incisors in the seven-year-old horse have their lateral outlines considerably elongated as compared with the same teeth at six years old. This change is less marked in the lateral and corner teeth. The latter, however, have their tables fully formed. A line of wear, narrower at the posterior than at the anterior edge, encircles the central cavity as shown in the next figure (fig. 615).

At eight years old the triangular form of the incisors is still more marked. The central enamel in the central teeth corresponds in its tri-

angular form to the general outline of the table, and in all the teeth the "mark" is extremely small as compared with the seven-year-old mouth. The tusks are also rounded at their points (fig. 616).

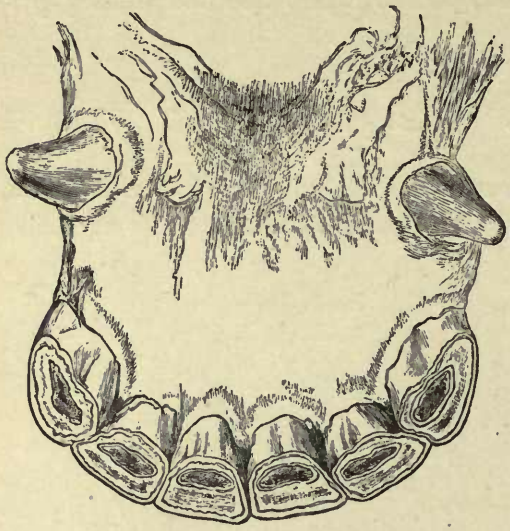


Fig. 615.—Incisors of Horse at seven years

After eight years of age some variation in the appearance of the teeth, owing to the continued attrition, may be expected; but it is not possible to decide with absolute certainty in many cases whether a horse is eight or nine years of age. At ten years old, however, the evidence is fairly definite. The so-called "marks" in all the teeth are nearly obliterated, but the circle of central enamel still remains quite distinct on the tables in all the teeth, nearer to the posterior than to the anterior edge, and at ten years old the figure of central enamel is nearly round. At this age, also, a very important mark is present. At the upper part of the top corner tooth on each side, close to the gum, a distinct

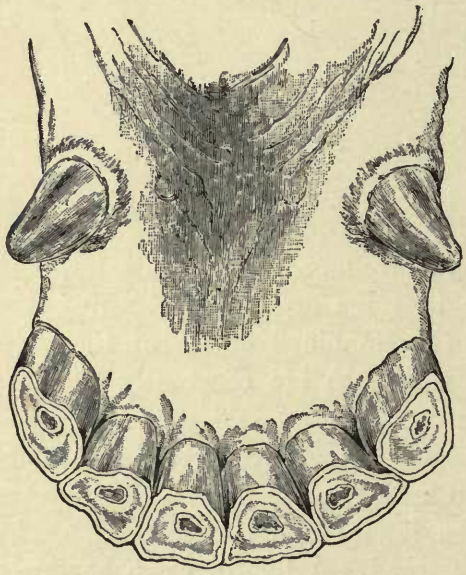


Fig. 616.—Incisors of Horse at eight years

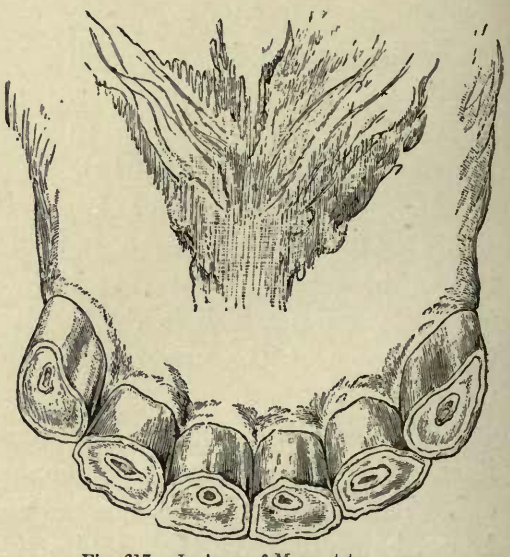
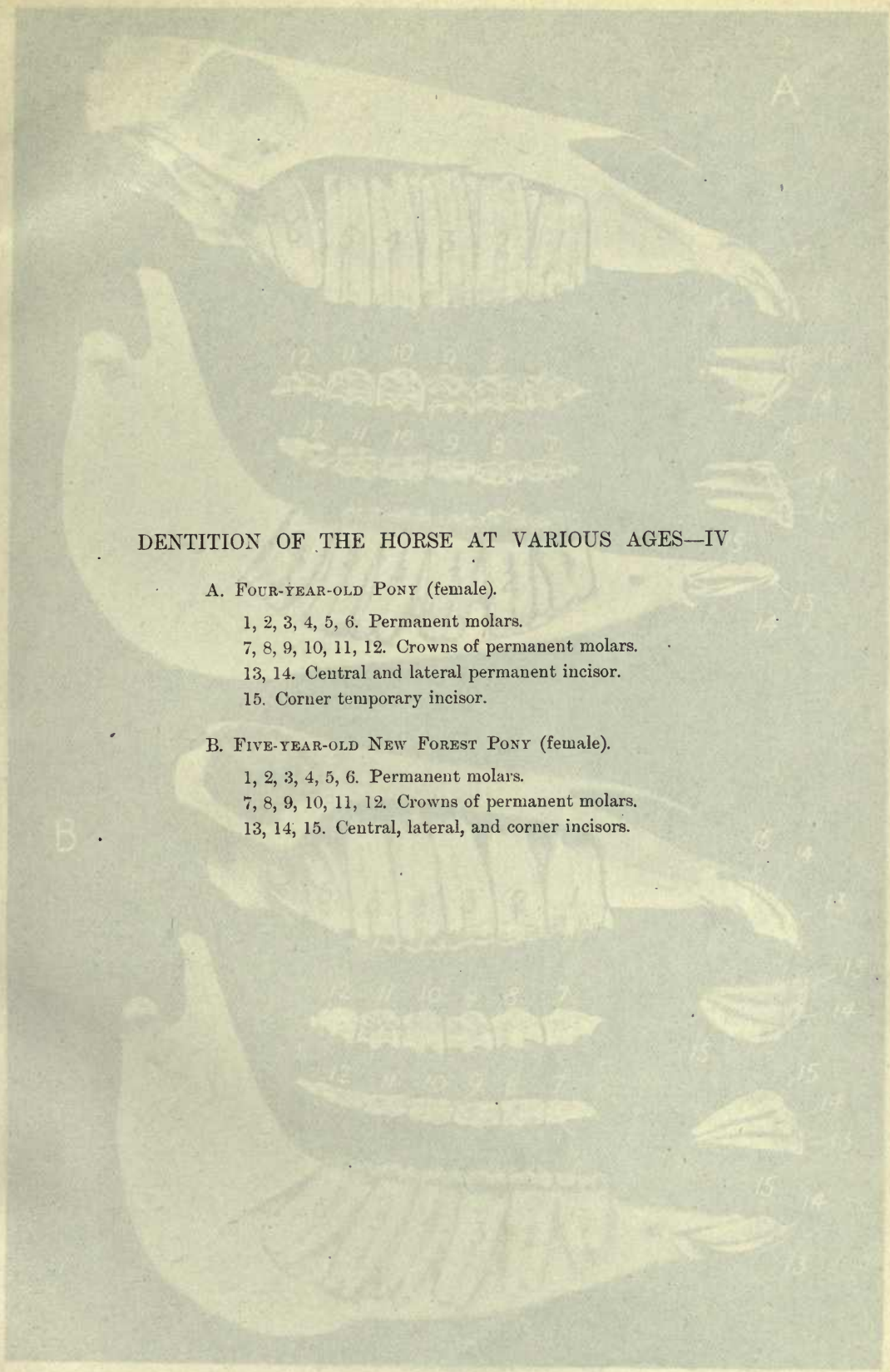


Fig. 617.—Incisors of Mare at ten years

depression, which is really the base of a long groove, begins to appear. This point will be alluded to further. The condition of the tables of the incisor teeth at ten years old is shown in the next drawing (fig. 617).



DENTITION OF THE HORSE AT VARIOUS AGES—IV

A. Four-year-old Pony (female).

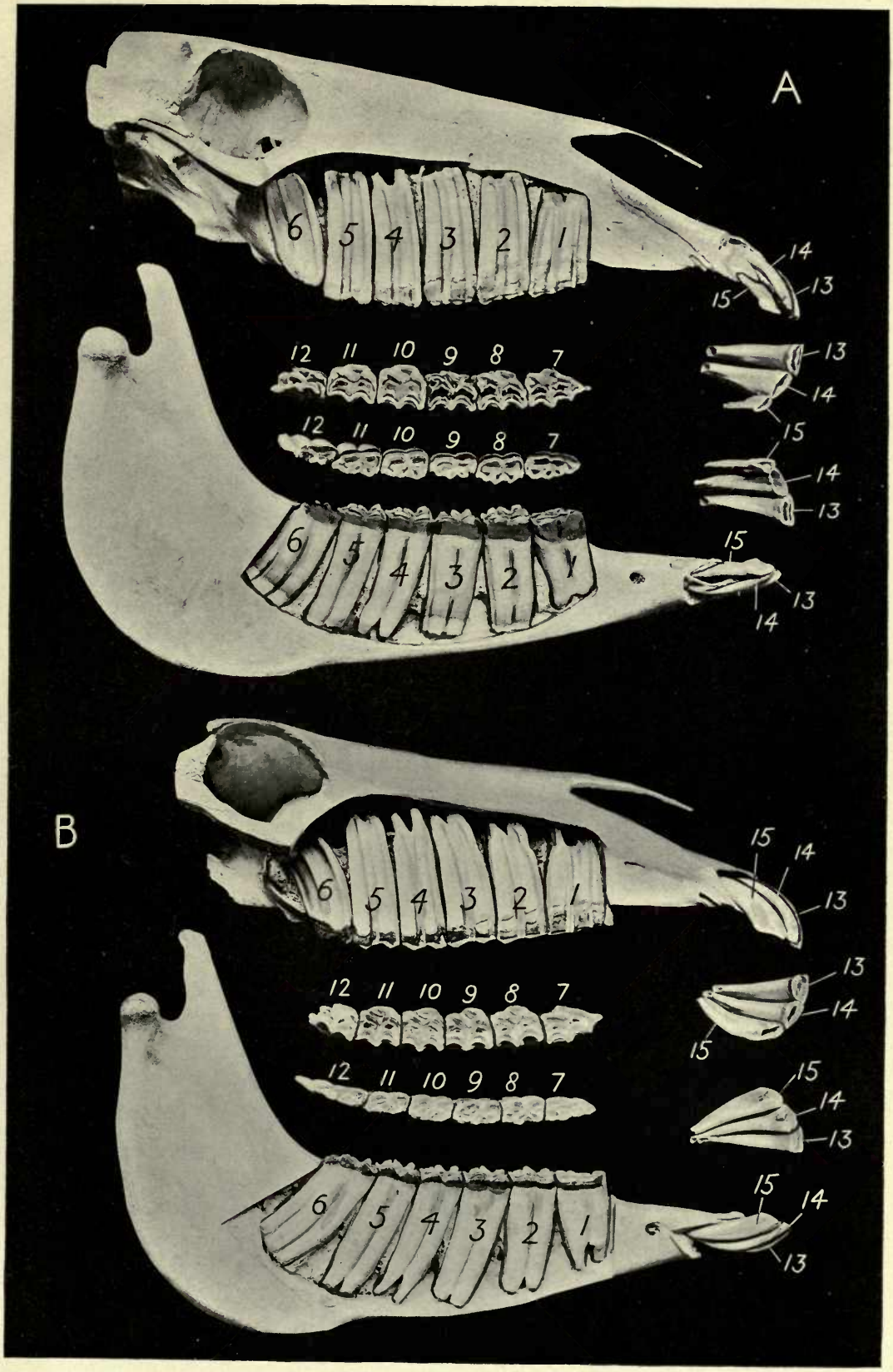
1, 2, 3, 4, 5, 6. Permanent molars.
7, 8, 9, 10, 11, 12. Crowns of permanent molars.
13, 14. Central and lateral permanent incisor.
15. Corner temporary incisor.

B. Five-year-old New Forest Pony (female).

1, 2, 3, 4, 5, 6. Permanent molars.
7, 8, 9, 10, 11, 12. Crowns of permanent molars.
13, 14, 15. Central, lateral, and corner incisors.

Fig. 616.—Incisors of Horse at seven years.

Fig. 617.—Incisors of Horse at eight years.



DENTITION OF THE HORSE AT VARIOUS AGES—IV

A. Four-year-old Pony (female). B. Five-year-old New Forest Pony (female).

EVIDENCE OF AGE AFTER TEN YEARS

Some years ago Mr. Sidney Galvayne made public a new method of judging the age of the horse up to the latest period of the animal's life, and as his system has proved to be extremely useful when it has been applied to old horses, the date of whose birth happened to be known or could be ascertained within reasonable limits by collateral evidence, it is desirable to rely upon that system exclusively after the age of ten years.

Mr. Galvayne's discovery, as it may be called, is based on the existence of a groove in the fang of the upper corner incisors. The groove is not visible in the living animal until the age of ten years, by which time

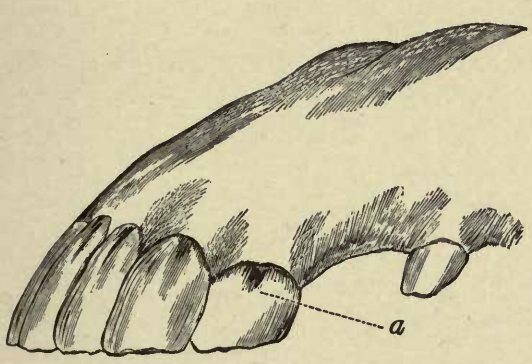


Fig. 618.—(*a*) Groove at the side of Upper Corner Incisor at ten years

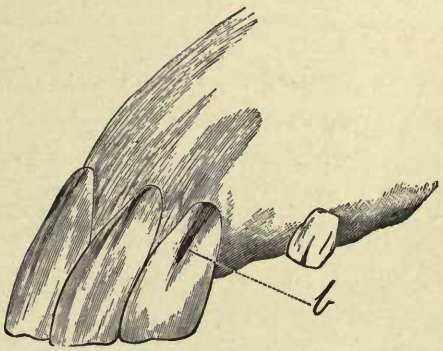


Fig. 619.—(*b*) Groove reaching half-way down the Corner Incisor at fifteen to sixteen years

the bone of the alveolar cavity, which contains the tooth, has shrunk. The tooth meanwhile has grown, or has been pushed forward, to an extent corresponding with the wear at the surface, and the lateral groove is exposed as shown in the next figure (fig. 618).

The method of judging the age from the point indicated in the above illustration is extremely simple. It is only necessary to recollect that, as the tooth continues to grow, and is at the same time constantly being worn, that part of the groove which is shown in fig. 618 will, at a certain period, be at the bottom of the tooth, and therefore year after year more of it will be seen. Eleven years, according to Mr. Galvayne's calculation, will elapse before the bottom of the groove reaches the cutting edge of the tooth. At that time, consequently, the animal will be twenty-one years old. When it is half-way down the tooth, as shown in fig. 619, the horse will be about sixteen years old.

The appreciation of the exact value to be attached to the gradual advance of the groove year by year can only be the result of close observation, but in any case the method is more reliable than any other which has

been devised. The next illustration shows the groove extending the whole length of the tooth at the age of twenty-one years (fig. 620),

From the age of twenty-one another process has to be noted, which ends with the total obliteration of the groove through the combined processes of wear and growth in the course of another nine or ten years. The drawing below shows that the groove has been half worn out from below, and the smooth, ungrooved surface of the previously concealed portion of the organ has grown downwards, which indicates the animal to be twenty-six years old (fig. 621).

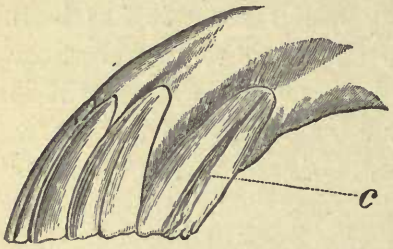


Fig. 620.—(*c*) Groove extending the whole length of the Corner Incisor at twenty-one years

In the course of another four or five years only a trace of the groove is seen at the cutting edge of the tooth, the structure up to the place where the gum encircles it being perfectly smooth. This condition is shown in the next drawing and indicates that the animal is thirty years old (fig. 622).

It cannot, of course, be suggested that any great importance has to be attached to the means of judging a horse's age from twelve, when the

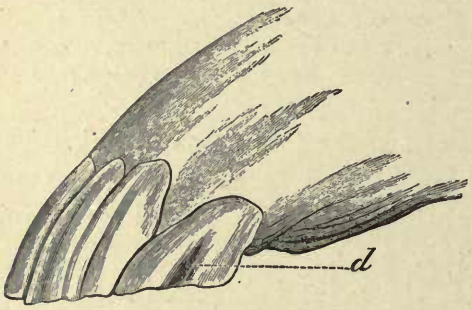


Fig. 621.—(*d*) Groove grown down from the gum, leaving the upper part of the tooth smooth at twenty-six years

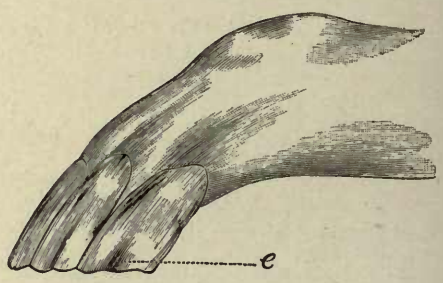
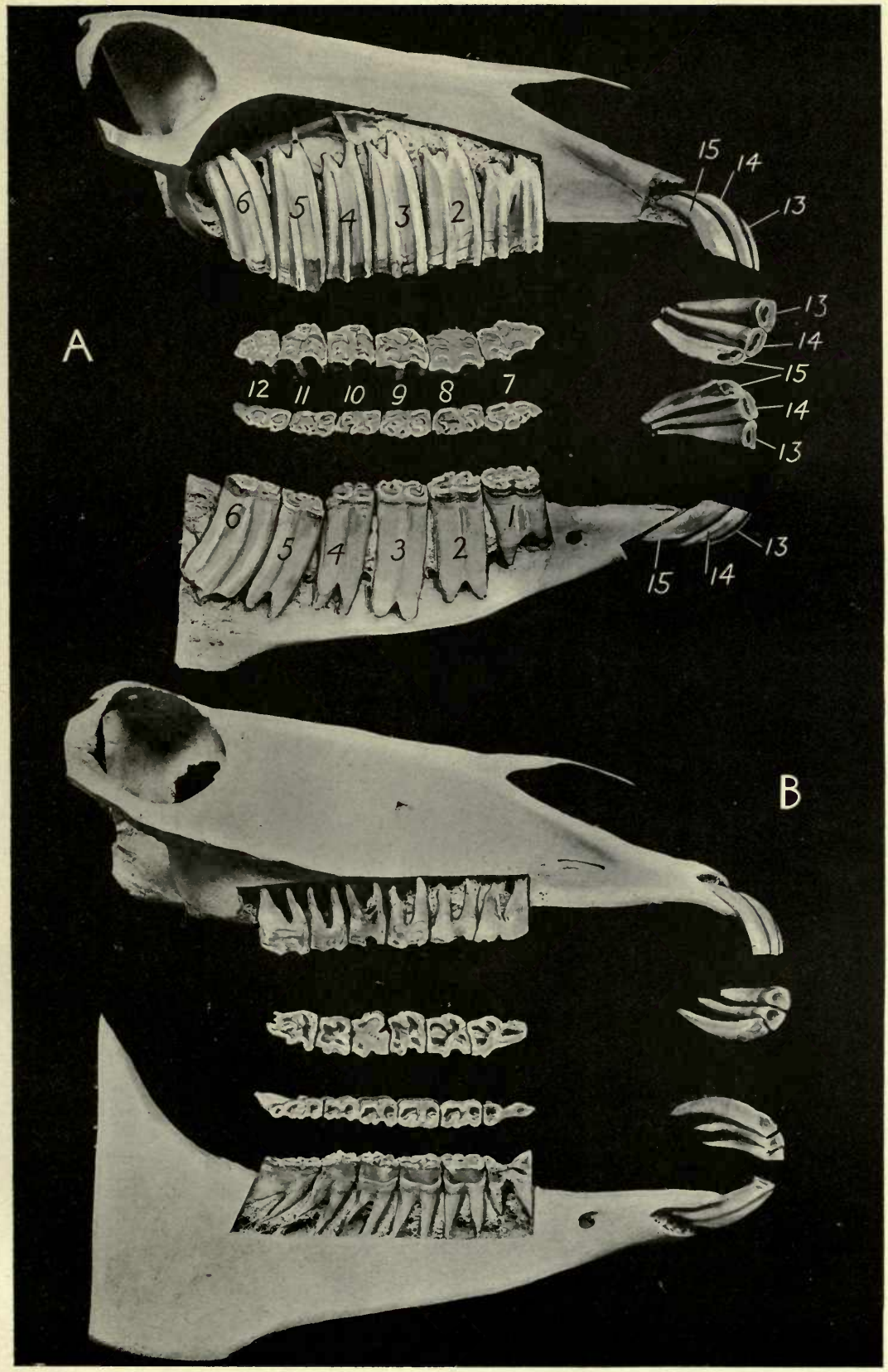


Fig. 622.—(*e*) Groove nearly worn out, upper part of incisor round and smooth, at thirty years

animal would be called aged up to thirty, when he would usually be worn out; but the horseman will find some interest in comparing the drawings which have been given with the mark in the corner tooth in any cases which may come under his notice of horses whose ages are accurately known.

*** The illustrations in this section are reproduced by permission of the Council of the Royal Agricultural Society of England from the pamphlet by Professor Sir George T. Brown, C.B., entitled "Dentition as Indicative of the Age of the Animals of the Farm".



DENTITION OF THE HORSE AT VARIOUS AGES—V

A. Six-year-old New Forest Pony (female)—all the teeth are permanent and show effects of wear.

B. Very aged New Forest Pony—the fangs of the teeth have become forked, and the crowns are thin as the result of wear.

WARRANTY

SECTION XI.—WARRANTY

A warranty is a guarantee given by the seller to the buyer that a horse answers the description given of it at the time of sale.

Such a warranty forms no essential part in the sale of a horse, but so risky is it to purchase without one, that in the sale of valuable animals it is rarely dispensed with. No special form of words is necessary to create a warranty, nor need they be in writing, though, to avoid disputes or litigation, it is obviously prudent to obtain a written warranty wherever possible. *Mutatis mutandis*, a warranty usually runs somewhat as follows:—

"Received of Mr. John Jones of Newborough the sum of fifty guineas for a chestnut mare, warranted quiet to ride and drive. WM. BROWN.

"Peterborough, *March 14th, 19——*."

Such a warranty need not be, and in fact rarely is, written at the time the warranty is given. All it amounts to is a memorandum of such warranty, reduced to writing at the time the money is paid.

No stamp is required beyond the receipt stamp, and if the warranty be on a piece of paper distinct from the receipt, even this is unnecessary. (*Skime v. Elmore*, 2 Camp. 407, citing *Brown and Try.*) Where a written receipt is given, but no mention is made of warranty, such warranty may be proved by parole or oral evidence. (*Allen v. Pink*, 4 M. v. W. 140.) It should be noted that though the words "warrant" and "sound" constantly occur in warranties, such words are not essential, as already intimated.

In *Paisley v. Freeman*, 1789 (2 Smith's leading cases), Mr. Justice Buller says: "It was rightly held by Holt, Chief-justice (in *Cross v. Gardner*, Carthew 90, 1689), and has been uniformly adopted ever since, that an affirmation at the time of a sale is a warranty, provided it appears in evidence to have been so intended". Whether a warranty is intended or not is a question of fact for the jury.

General Warranty.—There are several kinds of warranty. It may be *general*, as where the seller says: "I warrant the horse", or "the horse is sound". In such a case all the buyer has to do, if the horse is unsound, is to prove that it was so at the time it was sold.

Qualified Warranty.—Or there may be a *qualified* warranty, as where the seller says: "The horse is sound to the best of my belief". In this case, if the horse is not sound, the buyer must be prepared to prove, not only that the horse was unsound at the time of sale, but that the seller knew of such unsoundness.

A statement "that the buyer might depend upon it that the horse was perfectly quiet and free from vice" has been held to be a warranty (*Cave v. Colman*, 3 Man and R. 2, 1828).

Another kind of warranty is that known as a *limited* warranty, where any objections a buyer may have to make must be made within a stated time, or the horse must be retained with all faults.

This is a kind of warranty commonly employed at public sales and repositories. For instance, horses sold by Messrs. Tattersall at Albert Gate, at their Monday sales, "not answering the description, must be returned before five o'clock on Wednesday evening next; otherwise the purchaser shall be obliged to keep the lot with all faults" (Revised catalogue, March 16th, 1896).

In the case of *Head v. Tattersall* (L.R. 7, Ex. 7, 1871), where the above condition was discussed, two important points were decided. There, before the horse was removed, the buyer was told by the groom in charge of such horse that the warranty given with it was wrong, and it was contended that the buyer in removing the horse after such notice had waived his right under the warranty. The court, however, held that the statement of the groom was not equivalent to a notice by the defendants that the warranty was incorrect. The other point argued was whether the fact that the horse received some injury while in the custody of the buyer deprived the latter of his right to return it. On this point Baron Bramwell remarked: "It is quite true as a general proposition that a buyer cannot return a specific chattel except it be in the same state as when it was bought; but in such a case as the present the rule must be qualified thus: the buyer must return the horse in the same condition as when he bought it, but subject to any of those incidents to which the horse might be liable, either from its inherent nature or from the course of the exercise by the buyer of those rights over it which the contract gave. For example, suppose the horse when standing in the stable strained itself or injured a limb, that would not affect the right of return, although the horse would no longer be in exactly the same condition as before."

Further, if a horse be sold at a repository where a public notice is fixed up that warranties given there are subject to such notice, the buyer is bound by such notice, though it is not particularly referred to at the time of sale (*Bywater v. Richardson*, 1834) I. a v. E. 508. In *Chapman v. Gwyther* it was held (I. L.R.Q.B., 463) that when the horse was unsound at the time of sale, but complaint of unsoundness was to be made within a month, and such unsoundness was not discovered within a month of the sale, the buyer was without remedy.

Special Warranty.—There is a further warranty known as *special* warranty. Such a warranty arises when both parties are cognisant of defect, and when the buyer in the one case wishes to render the seller answerable for any consequences that may arise from such defect, or the seller, on the other hand, wishes to protect himself against them.

For instance, in *Chanter v. Hopkins* (4 M. v. W. 406, 1838) the court stated: "If a party offered to sell me a horse of such a description as would suit my carriage, he could not fix in me the liability to pay for it unless it were a horse fit for the purpose it was wanted for; but if I describe it as a particular bay horse, in that case the contract is performed by his sending that horse". A representation that a horse is "a good drawer and pulls quietly in harness" is a warranty that it is quiet in harness and pulls well there. "Good" means good in all respects (*Coltherd v. Puncheon*, 2 D. and R. 10; *Smith v. Parsons*, 8 C, b. P. 199).

A high or sound price is no proof of warranty (per Justice Grose in *Parkinson v. Lee*, 2 East. 314, 1802); but generally in the absence of express warranty the law does not imply a warranty as to goodness or quality upon sales of goods. The sale is *caveat emptor*. The buyer takes at his own risk, and in general no liability is incurred by reason of bad quality or defects, unless there be an express warranty or fraud. According to Mr. Justice Grose in the case above cited, "there must either be an express warranty of soundness or fraud in the seller to maintain an action".

REPRESENTATIONS THAT DO NOT AMOUNT TO WARRANTY

Whether representations made by a seller constitute a warranty is frequently a matter of extreme difficulty to decide. Mere loose words of commendation, even though they may induce a purchaser to buy, do not therefore amount to a warranty, as if a seller were to say: "I can fully recommend this horse," or "I would sell it to my dearest friend". (*Lascelles on Horse Warranty*, 2nd edition, 1881, p. 46.) A warranty may, however, be gathered from a series of letters passing between the parties,

as in *Salmon v. Ward* (2 C. v. P. 211, 1825). In that case C. J. Best says: "The question is whether the jury and I can collect that a warranty took place; I quite agree that there is a difference between a warranty and a representation, because a representation must be known to be wrong. The plaintiff in his letter says: 'you remember you represented the horse to be five years old', to which the defendant answers, 'the horse is as I represented it'." The jury found that there was a warranty.

Hopkins v. Tanqueray (15 C.B. 130; 23 L.V. C.P. 102, 1854) affords an excellent illustration of the difference between a mere representation and a warranty. In that case, on the day before the sale, while the plaintiff was looking at the horse in the stable, the defendant came in and said to the plaintiff: "You have nothing to look for, I assure you; he is perfectly sound in every respect," and the plaintiff replied: "If you say so, I am satisfied," and bought the horse, presumably on the strength of the defendant's representation. In an action on the assumed warranty the court ruled that there was no warranty. This case, too, confirms the ruling in *West v. Jackson* (16, 2 B. 280, 1851) that the warranty must be made during the treaty; antecedent representations in no way affect the validity of the sale.

When a representation is made during actual treaty, which afterwards becomes an important factor in the transaction, it constitutes an intrinsic part of the warranty; but if it forms no part of contract, but was merely made by the vendor to induce the purchaser to buy, it is not a warranty.

No action, it should be noted, will lie for simple misrepresentation: "The rule which is to be derived from all the cases is that where, upon the sale of goods, the purchaser is satisfied without requiring a warranty, he cannot recover upon a mere representation of the quality by the seller, unless he can show that such representation was bottomed in fraud" (*Ormrod v. Huth*, 14 M. v. W. 651). Where the misrepresentation is perfectly innocent, both parties believing the horse to be sound, a slightly different construction is put upon the transaction, according as there is or is not a general warranty. In the former case the buyer has a remedy, as the seller is liable for the mistake; but where there is no warranty, the buyer must pay the price agreed upon. In *Kennedy v. Panama &c. Mail Co.* (L.R. 2 B. 580, 587, Ex. Ch., 1867) Mr. Justice Blackburn says: "There is, however, a very important difference between cases where a contract may be rescinded on account of fraud and those in which it might be rescinded on the ground that there is a difference in substance between the thing bargained for and that obtained. It is enough to show that there was a fraudulent representation as to *any part* of that which induced

the party to enter into the contract which he seeks to rescind; but when there has been an innocent misrepresentation or misapprehension, it does not authorize a rescission unless it is such as to show that there is complete difference in substance between what was supposed to be and what was taken, so as to constitute a failure of consideration. For example, when a horse is bought under the belief that it is sound, if the purchaser was induced to buy by a fraudulent representation as to the horse's soundness, the contract may be rescinded. If it was induced by an honest misrepresentation as to its soundness, though it may be clear that both the vendor and purchaser thought they were dealing about a sound horse and were in error, yet the purchaser must pay the whole price, unless there was a warranty."

Formerly there could be no warranty against future unsoundness, and so Blackstone lays down; but the law now is different, and in *Eden v. Parkinson* (2 Douglas, 732) it is distinctly stated, "There is no doubt you may warrant a future event".

FRAUD

Fraud has already been incidentally adverted to as vitiating a contract of sale.

As, however, fraud, or deceit, as it is alternatively called, is a word of somewhat vague import, and actionable fraud differs considerably from what is commonly regarded as fraud, some consideration of it in a work of this kind is necessary.

As commonly understood, fraud is a much more heinous offence against morality than the law requires to form the ground of an action for deceit. It appears, however, to be now well settled that some amount of moral delinquency is necessary to support such an action. What amount of moral delinquency is necessary to render a misrepresentation fraudulent was fully discussed in the celebrated case of *Derry v. Peck* (L.R. appeal cases, H.L. p. 337 foll.), in which it was finally settled that to support an action for deceit there must be an intention to defraud. "No honest mistake, no mistake not prompted by a dishonest intention is fraud" (*Derry v. Peck*, supra p. 339). A statement "may be inaccurate, yet if the defendants honestly, though mistakenly, believed that it substantially represented the truth, there is no fraud, and an action for deceit will not lie". In other words, there must be moral culpability; and therefore the fact that a statement was unreasonable will not render it fraudulent if a belief in its truth was honestly entertained by the person making it. "To believe without reasonable grounds is not moral culpability, but mental

culpability." Of course, a statement may be so utterly irrational, so destitute of all reasonable foundation, as to furnish strong evidence of dishonesty; but the mere fact that it is unreasonable does not *per se* render it fraudulent.

In giving his opinion in the above case of *Derry v. Peck*, Lord Fitzgerald refers with approval to the words of Popham, Chief-justice, in a previous case:

"That if I have any commodities which are damaged (whether victuals or otherwise), and I, *knowing them to be so*, sell them for good, and affirm them to be so, an action upon the case lies for the deceit; but although they be damaged, if I, *knowing not that*, affirm them to be good, still no action lies, without I warrant them to be good." "Popham", Lord Fitzgerald remarks, "had the reputation of being a consummate lawyer." It should be observed that where a warranty is given, misrepresentation alone, where it forms part of the warranty, even though not fraudulent, might be a sufficient ground for rescinding the contract.

Fraud may conveniently be divided into three kinds:—

(1) Misrepresentations tainted with fraud.
(2) Industrious concealment of defects.
(3) Suppression of material facts.

Of these (1) and (2) may be said to constitute positive, (3) negative fraud.

The first kind of fraud has already been alluded to in the foregoing remarks. A false statement of this nature, it would appear, will only amount to a fraud in horse warranty when it forms a material part of the contract, or when, as above noticed, it is made during actual treaty. It may be generally remarked that no statement, fraudulent or otherwise, antecedent to treaty, or made after a bargain has been struck, will affect a warranty.

Examples of the second kind of fraud are the stopping up of "sand cracks", painting over of broken knees, or any similar trick or device to induce a sale or obtain a higher price. A fraud of this kind would vitiate even a sale expressed to be "with all faults".

The third kind of fraud, suppression of material facts, would seem to apply to horse warranty only where the buyer has no power of inspection, and relies upon the integrity of the seller. There it would appear to be of the essence of the contract that the seller shall disclose all material facts. Generally, however, the rule of *caveat emptor* applies, and the vendor is under no obligation to disclose faults which a purchaser may discover for himself. In *Peck v. Gurney* (L.R. 6, H.L. 403), which

is quoted in *Derry v. Peck*, Lord Cairns says: "There must, in my opinion, be some active misrepresentation of fact, or, at all events, such a partial and fragmentary statement of fact as that the withholding of that which is not stated makes that which is stated absolutely false"; and Lord Blackburn says: "Even if the vendor was aware that the purchaser thought the article possessed that quality, and would not have entered into the contract unless he had so thought, still the purchaser is bound, unless the vendor was guilty of some fraud or deceit upon him, and a mere abstinence from disabusing the purchaser of that impression is not fraud or deceit; for whatever may be the case in a court of morals, there is no legal obligation on the vendor to inform the purchaser that he is under a mistake, not induced by the act of the vendor" (*Smith v. Hughes*, L.R. 6, C.P. 597).

Where two or more are concerned in a fraud, it is a criminal offence and amounts to conspiracy. In his "Digest of the Criminal Law" Sir James Stephen remarks (art. 336): "Everyone commits the misdemeanour of conspiracy who agrees with any other person or persons to do any act with intent to defraud the public, or any particular person, or class of persons. . . . Such conspiracy may be criminal, although the act agreed upon is not in itself a crime. I select two of the examples given. A conspiracy to induce a person to buy horses by falsely alleging that they were the property of a private person and not of a horse-dealer (*R. v. Kenrick*, 5, 2 B. 49), or a conspiracy to induce a man to take a lower price than that for which he had sold a horse by representing that it had been discovered to be unsound, and resold for less than had been given for it (Carlisle's Case, Drar. 337), are conspiracies to defraud."

Fraud, however, as I have already stated, is so many-sided, and assumes so many different forms, that it would be unwise in the extreme to rely upon it as a ground for rescinding a warranty without taking qualified legal advice. The above brief sketch is merely intended to give a general idea of what is meant by actionable fraud, of which even the law itself attempts no definition.

PATENT DEFECTS

Warranty generally does not extend to cover patent or obvious defects. This was laid down long ago in *Bailey v. Merrell* (3 Bulstrode, 95). Yet, in the purchase of horses, so strongly has the principle of warranty been upheld in England, that it is not safe to rely implicitly upon this rule. In *Siddard v. Kain* (2 Bingham, 183), the plaintiff sold two horses to the defendant, telling him at the time of sale that

one of them had a cold, but warranting them nevertheless "sound and free from blemish at the end of a fortnight".

At the end of the fortnight the buyer refused to complete, as one horse still had a cold and the other a swollen leg. The plaintiff thereupon brought his action for the price, but the jury found for the buyer, and refused a motion for a new trial, on the ground that the warranty applied not to the time of sale but to a future date. This decision recognized the general rule as to patent defects, but found for the buyer apparently on the ground that, the horses not being sound within the time stipulated, he was free to repudiate the contract.

Another case, which cannot be regarded as altogether satisfactory, is that of *Margetson v. Wright* (17 Bingham, 603; *vide* Bingham, 454). In this case the plaintiff, a lawyer, bought a horse for racing purposes of the defendant, who was a horse-dealer. At the time of sale the defendant pointed out to the plaintiff that the animal was a crib-biter, and had had a splint, and in consideration of these faults agreed to take a less price than he would have otherwise accepted. The warranty was in these words:

"And the said Mr. Wright does hereby warrant the said horse to be sound, at this time, in wind and limb".

The horse was taken away, put into training, and at the end of six months broke down, and the plaintiff thereupon brought an action and recovered a verdict for breach of warranty.

A new trial was applied for and granted, and again the jury found for the buyer, on the ground "that, although the horse had exhibited no symptoms of lameness when the contract was made, he had upon him the seeds of unsoundness at the time of the contract, arising from the splint". A motion for another new trial was refused.

The moral to be drawn from this case, is that no one who sells a horse with a patent defect should warrant it without a memorandum upon such warranty that he will not be responsible for any consequences that may arise from such a defect. In another case, *Smith v. O'Bryan* (*Law Times*, *N.S.* 346), the jury gave a verdict for the plaintiff on somewhat similar grounds. There the horse fell lame after sale, and the jury found that such lameness arose from a certain splint to which the owner had called the plaintiff's attention at the time of sale. Of course, as already intimated, the general rule that a warranty does not extend to patent defects does not apply where the buyer has no power of inspection: "Where there is no opportunity to inspect the commodity, the maxim *caveat emptor* does not apply" (per Lord Ellenborough, in *Gardiner v. Gray*, 4 Camp. 144).

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